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OF

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JULY, 1907—APRIL, 1909

EDITED BY

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Introduction.

The Journal of the Board of Agriculture of British Guiana, of which this is the first issue, appears with the object of supplying in a popular form information of an agricultural character suited to the requirements of this colony.

The want of a journal of this kind has long been felt and more especially within recent years, owing to the increased interest taken in general agriculture since the formation of the Board of Agriculture of this Colony.

The suggestion of starting a periodical of this nature originated with the first Chairman of the Board, the late Sir A. M. Ashmore, K.C.M.G. It was not, however, until July of last year that the proposal to issue one was brought before the Board and received the assent of the members. A Committee was appointed to decide on the character and scope of the proposed journal and the approval of His Excellency the Governor Sir F. M. Hodgson, K.C.M.G., was obtained for placing a sum of money on the Estimates for the purpose.

A large amount of information on agricultural matters is already provided in this part of the world by the admirable periodical publications of the Imperial Department of Agriculture for the West Indies, the Botanical Departments of Trinidad and Jamaica and the Agricultural Society of the latter island. The circumstances and conditions, however, obtaining in the West Indian Islands are in many respects very different from those prevailing on the mainland of South America and hence require specially catering for, which will be the object of this journal.

First of all then, our idea will be to benefit the numerous class of small farmers of this colony by providing plainly worded information and practical advice on various agricultural matters, taking into account local conditions. By means of this paper we shall endeavour not only to show them how to improve their present methods of agriculture but also to inform them of other products worthy of cultivation and how to set about growing them.

Secondly, it is hoped to interest the sugar planters and owners and managers of other large estates, by bringing to their notice by means of this journal improvements that have been effected

in the production of their special products on a large scale in other countries, and also by keeping them informed of the results of the experiments that are being carried out under the Department of Science and Agriculture with sugar-canes, rubber, rice, cacao, etc. Much of the information with regard to these experiments is at present available only in the various official Reports published from time to time and is only brought to the notice of the public by references made to it in the local press.

The various fungus diseases and insect pests to the attacks of which all crops are liable at some time or other will be dealt with in our journal and, as far as possible, means suggested for their prevention or destruction.

Thirdly, an endeavour will be made to attract attention and to supply information with regard to the as yet almost unexplored and undeveloped resources of our forests, which occupy an area many times in excess of the lands under cultivation.

To assist in the work of this journal, correspondence on agricultural matters is cordially invited, whereby the experience of cultivators and others may become available for the general benefit of the colony. Suitable articles and letters will be published, as far as the space at our disposal will allow.

It is proposed to issue the Journal of the Board of Agricultural in future every quarter, and the numbers are due to appear early in the months of April, July, October and January. The price at which the Journal is published should bring it within the reach of every person owning or cultivating land in British Guiana.

A. W. BARTLETT.

THE JOURNAL

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VOL. I. JUNE, 1907. No. 1.

The Native Rubber Trees of British Guiana.

The trees so far known as capable of producing or likely to produce rubber, growing wild in British Guiana belong to the three genera, Sapium, Hevea and Forsteronia, the first two of which are included in the natural order Euphorbiaceoe, while Forsteronia belongs to the Apocynaceœ.

Numerous species of Ficus, known locally as Cumakaballi occur in the forests, but the latex of none of them has so far been found to yield a sufficient amount of rubber to make the collection of it profitable.

Mimusops globosa, Gaertn. yields balata, a product which occupies a somewhat intermediate position between india-rubber and gutta-percha both in its composition and in its physical properties, and which fetches a price less than half of that usually obtained for the former.

SAPIUM.

The genus Sapium is widely distributed throughout the tropics of both the Old and New Worlds.

The majority of the species are found in South America, including the West Indies, but representatives occur in Tropical Asia, Australia, Malaya, China, Tropical Africa and Madagascar. With the exception of three or four species in South America I can find no reference to this genus as containing trees, capable of yielding India-rubber.

The members of the genus are large shrubs or trees sometimes reaching a considerable size, bearing simple, stalked leaves. A very distinctive character of the leaves, which is found in most of the species, is the presence of two small glands usually just below the point where the blade of the leaf joins the stalk.

The flowers are small and inconspicuous and grow in long spikes which bear a few female flowers at the base, while the

greater part of the spike is made up of male flowers. The male flowers have a membraneous calyx with two or three divisions, which encloses two or three stamens. The female flowers have a similar 3-lobed calyx which surrounds an ovary usually with two or three loculi, each containing one ovule.

The fruit is a dry capsule measuring, not more than ½ inch in diameter, showing distinctly usually three divisions, which splits open when ripe disclosing one seed in each cavity.

The fresh seeds are surrounded by a thin pulp which is bright red in colour when the seeds are ripe in our native species. This pulp, which in botany is known as the aril, though quite tasteless is much sought after by ants, which soon strip it from the seeds when they can get to them. I fancy also that this bright-coloured aril must serve as a source of attraction to birds, because young plants are frequently found springing up in places at long distances from any Sapium trees. The seed-coat beneath the pulp is dark in colour and very hard, so that the seeds if swallowed by a bird could probably pass through its alimentary canal without injury.

The seeds measure not more than ¼ inch in diameter and on account of their small size are somewhat difficult to find when they fall on rough ground. In October 1905 I was informed that the Indians on the Aruka River in spite of their keen powers of observation declared they had not seen the seeds although they were accustomed to collect the rubber from the trees and also the young plants when they found that there was a ready sale to be obtained for them.

Observations seem to show that the trees flower from December to February and ripen seeds from March to May.

All of the specimens of Sapium which were collected and sent to Kew by the late Government Botanist, Mr. G. S. Jenman, have been referred to three species Sapium Jenmani. Hemsl., S. aucuparium Jacq. and S. paucinervum, Hemsl. Some of the earlier specimens were referred to S. biglandulosum Muell. Arg., but according to the compiler of the Index Kewensis, this species has been considered as identical with S. aucuparium, Jacq,*

* In a copy of a paper I have just received through the kindness of the author Mons. J. Huber of the Para Museum, entitled " Revue Critique des Especes du genre Sapium." I observe that our specimens identified as Sapium aucuparium, Jacq. have been referred to a new species, S. Hemsleyanum, Huber. In order to avoid confusion, I prefer in this account to adhere to the former name by which several people in the colony have learnt to know the tree.

Sapium Jenmani. Hemsl.

This species was named after Mr. Jenman, who first discovered it and to whom we are indebted for most of our knowledge of this and of the other species of Sapium found in the colony. It may be easily distinguished from the other two that I have mentioned by the leaves ending rather suddenly in a long blunt point, not a hooked gland, by the two glands at the junction of the leaf with the stalk being small and inconspicuous and by the leaf bearing numerous minute transparent dots which do not show plainly in the fresh leaves, but are most easily seen by holding a dried leaf up against the light.

When the tree is in fruit, another distinguishing characteristic will be found in the fruit containing only one seed instead of the usual three and by its splitting open into two halves when ripe.

The Carabisi Indians know this tree under the name Touch-pong* while the Arawacks call it Hya-hya.

Sapium Jenmani grows to a considerable size. Mr. Jenman speaks of it as " one of the largest trees in the forest " while Mr. J. E. Beckett in a report on an expedition undertaken to collect young plants of Sapium felled a tree presumably of this species, which three feet from the ground had a circumference of five feet while another specimen is mentioned which had a height of about 110 feet and a girth 3 feet from the ground of nine and a half feet.

The species is widely spread throughout the lower forest lands of the colony but seems to be scarce in the immediate neighbourhood of the coast, the only specimen of which I am aware being one planted in the Botanic Gardens which is of very stunted growth.

Sapium Aucuparium, Jacq.

The character which in most cases serves to distinguish this species from the other two, occurring in British Guiana is the presence of a peculiar hooked gland at the apex of the leaf, which, however, is found in several other species growing out side the Colony.

(*Mr. Jenman adds the following interesting note with regard to the pronunciation of this word :— I have *very often* now heard the Indians pronounce the word, and I am myself satisfied that the first syllable is one of the innumerable cases in the Guiana languages of what is called an ' explosive.' That is to say there is a T sound brought out uttered with considerable and marked explosion and this constitutes the whole syllable. The best way to write it is probably this —t'pong.)

The leaves show very considerable variety in size and shape both in those occurring in different parts of the same tree, at different ages of the plant and on different individuals. Thus the leaves on the lowermost branches of some of the trees are destitute of the hooked apex and end in a long blunt point as in S. Jenmani. Also the leaves of young plants and of saplings even measuring 15 to 20 feet high are invariably wanting in this characteristic feature.

The two glands at the base of the leaf are much larger and more prominent than in S. Jenmani, they are thick at the base and taper towards the blunt apex. The rest of the characters described for the genus Sapium apply in general to this species. The fruits are about ½inch in diameter and split open into 3 valves, disclosing the 3 seeds covered by the red pulp or aril. When the aril is removed the dark coloured seed-coat underneath is found to be rough with small warts or tubercles.

S. Aucuparium is a tree very widely distributed throughout the coast region where it often reaches a considerable height though it never approaches the magnitude of S. Jenmani. There are many trees scattered about Georgetown and several occur in various parts of the Botanic Gardens where they have sprung up spontaneously, probably from seeds dropped by birds.

It is the "Gum-tree" of the creoles with which almost every boy is familiar and the trees wherever accessible are tapped for bird-lime. The trees in the Botanic Gardens show abundant evidence of this tapping, which must have been going on from the time that they were mere saplings for the bark from the base of the trunk to the topmost branches is everywhere scarred with cuts and slashes.

The method generally followed in collecting the 'gum' is to make a cut in the bark and then the viscid and very sticky latex which issues from the cut is wound off on thin sticks or wires. These are then stuck horizontally into a long stick placed upright in the ground so as to form attractive perches on which small birds may be likely to settle and are held past by the sticky gum.

Away from the coast in the lower forest region S. aucuparium does not seem to be nearly so plentiful or at any rate so widely distributed as S. Jenmani. During the three months spent by Mr. Beckett in the North-West District collecting Sapium seedlings and samples of rubber he came across no trees which appeared to him to belong to this species, although he found plenty of S. Jenmani.

From the evidence, I am inclined to think that S. Jenmani is limited to the forests, while S. Aucuparium is almost peculiar to the coast region.

SAPIUM PAUCINERVUM, HEMSL.

This is another species first discovered by Mr. Jenman, in March, 1886, occurring on the Pomeroon River above Maccaseema. Unfortunately only fruiting specimens were found and the description of the plant was based upon these. In March of the present year, Mr. Ward, Agricultural Superintendent brought back some specimens of a Sapium in fruit from the Camaria Road which were found to belong to the same species. Some leaves gathered by Mr. Beckett in the North-West District as well as some I obtained from some young saplings growing on the Hooboo Hills at the back of Mr. D. Young's grant also appear to be S. paucinervum. So that this species seems to be somewhat widely distributed through the forest region, but a more careful search is required to ascertain whether it is plentiful or not. The flowering stage is still unknown.

S. paucinervum is easily distinguished from the two species already described by the characters of the leaves apart from the fruits.

It differs from both of them by the fewness of the lateral veins springing from the midribs, of which there are seldom more than 10 pairs, except in the leaves from young plants.

The apex of the leaf ends in a long blunt point as in S. Jenmani, and is not hooked. The two glands at the base of the leaf are long and curved and the basal part is narrowed into a stalk. Sometimes these glands, instead of being at the junction of the blade and the leaf-stalk are placed rather higher up so that they spring from the base of the blade itself and in the dried specimens appear to be situated on the under-side of the leaf. The fruits of S. paucinervum show three well-marked divisions as in S. aucuparium but they are smaller, measuring when ripe $\frac{3}{8}$ inch across and the three seeds in each fruit are also smaller and rounder not exceeding $\frac{3}{16}$ inch in diameter.

They are as usual covered by a thin bright red pulp or aril except for one smooth, shiny, rounded spot on the outer side of each seed. When the aril is rubbed off, the black seed-coat beneath is slightly rough but not tuberculated or warted.

Mr. Jenman appends a note to the herbarium specimens of this plant, to the effect that it is associated by the Indians with the real Touchpong (S. Jenmani).

The following table shows clearly the characters I have described and will prove of assistance in discriminating between the different species by means of the leaves or fruit, alone, or both combined :—

	LEAVES.			FRUIT.	SEED.
	Glands at base.	Principal lateral veins.	Apex of leaf.		
S. aucuparium, Jacq.	Long and thick throughout	More than 10 pairs.	Bent over to form a hooked gland.	Shows clearly 3 divisions, nearly ½" diameter.	Outside covered with warts or tubercles, ¼" diameter.
S. Jenmani, Hemsl.	Small and wart-like.	Usually more than 10 pairs.	Long, straight and blunt.	Not divided into three, about ¾" diameter.	Outside finely warted, 3/16" diam
S. paucinervum, Hemsl.	Long, curved and situated on a stalk.	Usually less than 10 pairs.	Do.	Shows clearly 3 divisions, About ⅜" diameter.	Outside only slightly rough, 3/16" diam.

In endeavouring to identify the different species of Sapium, leaves should always be obtained if possible, from branches which bear fruit or flowers, or at any rate from branches as high up on the trees as one can reach. I have already pointed out that young saplings of S. aucuparium are wanting in the characteristic hooked gland at the apex of the leaf. Also the leaves of young plants of S. paucinervum or those found on sterile shoots usually possess more than 10 pairs of lateral veins, although they show plainly the long, curved, stalked glands of this species.

Rubber from Sapiums.

Unfortunately not much is at present definitely known about the most important thing in connection with the Sapiums, i.e. their rubber yielding capabilities. It may however be useful to bring together and to summarise as far as possible the facts that have been ascertained.

Discovery of the Rubber.

In an official report to the Government on some of the India-rubber and Gutta-Percha trees of British Guiana, published in 1883 and reprinted in "Timehri" in the same year, Mr. Jenman describes his first acquaintance with Sapium rubber. His attention was attracted to it by information received from Mr. now His Excellency Sir Everard Im Thurm, Governor of Fiji, who had seen in the coreal of some Carabisi Indians two or three small balls of india-rubber which were exceedingly elastic. Mr. Jenman sought out the collector and induced him to point out the trees whence it was obtained. I will quote Mr. Jenman's description.

"The trees were large individuals, four or five feet in diameter of trunk, and one hundred and twenty or more feet high. Their trunks were long, straight and unbranched for sixty or seventy feet from the ground. The lowest six feet of one had been scarred, and from the scars the milk had run and was dried in tears or strings several inches long on the bark. Most of the congealed rubber was, however, contained in the fissures made by the cutlass cuts, from which places it was rather hard to extract it because of the tenacity with which it held to the inner bark from which it had oozed. I gathered and made a ball, following the Indian plan of winding it up like twine, of what was on this trunk. They scar the trunk and then leave it, the milk oozes from the wounds, trickles down the bark and coagulates and becomes dry in a few days. My guide said it took three days to dry, but I should have supposed a shorter time might accomplish the change, the little rivulets are so very thin. That which was in the old cuts—cuts probably a year or more old—had turned black, but that in those recently made was nearly milk-white. The Indian boys, who are perhaps accustomed to play with the balls, as I noticed from several which they brought me they never make them large, stripped the dry strings very dexterously from the bark, taking good care to extract the larger portion to which I have alluded partly concealed in the incisions, and stretching it with a good deal of tension, wound it up. These balls have wonderful elasticity and bound with very little impulsion several feet off the ground. The rubber too seems exceedingly tenacious and strong. This method of collecting is that pursued in Ceara, the province of Brazil which produces Manihot Glaziovii. It is very economical of time for it saves the tedious operation of catching the milk in a vessel as it issues from the wound, which is the most bothersome of all the operations. The principal objection to it is, that the rubber

becomes soiled by the dirt adhering to the bark, a little of which it retains and no doubt this would deteriorate its market value; but this cause of depreciation might be reduced to a minimum by carefully brushing the surface down prior to commencing collecting operations. Rubber which has foreign matter incorporated with it, is classed under the term negro-head in the market, though its value depends on the measure of its freedom from dirt or other substance having regard of course to the quality of the rubber itself when clean."

"I regard the discovery of this tree of great interest and probable importance, attaining as it does to such a vast size and producing a material of apparently excellent quality. The Indians know it under two names, the Carabisi calling it *Touckpong* and the Arawacks, *Cumakaballi**. Noble in all its proportions, spreading and lifting its massive head above its neighbours it is one of the largest trees of the forest and has a wide and general distribution over the deep belt of low country in the colony, Samples of both this and the Hatie† I have sent to England to be tested as to their probable commercial value."

Mr. Jenman refers to these samples in a report published in 1885, on "Balata and the Balata Industry, Forest Laws, Etc."

"From a sample I sent home last year to be tested, touchpong rubber was very favourably spoken of as to quality and estimated as worth from 2/3 to 2/6 per lb., which is the highest estimated value that has been given by experts for any of the substances, balata or india-rubber.

In his book on "Para Rubber," Mr. Herbert Wright gives the price of some samples of Plantation Para rubber in 1884 and 1885 as 2s. 8d. and 2s. 5d. respectively, with which the value estimated for Sapium rubber does not compare so unfavourably. Also on 1st January 1885, Para Rubber of fine quality was selling at only 2s. 8d. per lb.

Another interesting fact mentioned by Mr. Jenman is that Touckpong was one of the trees, the latex of which was employed by the collectors of balata for adulterating that product, the quoted price of which at the time in the English market was 1s. 3d. per lb., i.e. half or less than half the value of the adulterant.

*Cumakaballi, an Indian name for all the larger species of Ficus and not properly applied to the Touckpong.

† Hatie, an Indian name for species of Hevea growing in this colony.

Method of Collection.

The Indians still employ the same method of collecting the rubber as that described by Mr Jenman more than twenty years ago, which causes very considerable injury to the trees. By means of a cutlass two horizontal, intersecting cuts are made so that a large wedge-shaped piece is removed, including not only the bark but some of the wood beneath. From specimens of the bark of trees tapped in this way, obtained by Mr. Ward, I should say that it would be impossible for the tree to repair the damage done and that a few of these cuts would be sufficient to completely ring and kill any but a very large tree. The danger of exterminating the Sapiums by this destructive mode of bleeding must be greater at the present day than formerly because the ready sale found and the good price obtained for the rubber has within the last few years considerably increased the amount collected.

Exports of Rubber

Rubber first appears under a separate heading among the articles exported from the colony in the Blue Book for 1904-1905; the following are the quantities in pounds annually exported and their value for the last three years :—

	Quantity.	Value.
1904-1905	951 lbs.	$ 603 20c.
1905-1906	4,114 „	$2,575 40c.
1906-1907	2,563 „	$1,613 70c.
Total for three years	7,628 lbs.	$4,792 30c.

Source of the Rubber.

So far as I have been able to ascertain, it seems probable that Sapium Jenmani is the main, if not the *only*, source of the rubber that has hitherto been obtained from British Guiana. Mr. Jenman's samples were obtained from this species, also all of the specimens collected by Messrs Ward and Beckett, and this is the species which occurs most abundantly of the three in the forest.

The species of the coast lands identified by Mr. W. B. Hemsley at Kew as Sapium ancuparium, Jacq. apparently yields little or no rubber. A small quantity of the latex collected from a fruiting tree of unknown age growing in the Botanic Gardens seemed to consist chiefly of an extremely sticky, resinous substance which I have mentioned before as employed by boys for catching birds. When dry it becomes hard and brittle.

Our experience however does not agree with the accounts given of the tree known as S. Aucuparium (?) growing in other parts of S. America. Dr. Huber of the Para State Museum writing of Para Rubber says " little of it is pure Hevea rubber but usually a mixture of the latices of H braziliensis and Sapium aucuparium. The rubber of S. Aucuparium has seldom been marketed alone and very little can be said definitely of its value. But when mixed with Hevea latex a rubber is produced not to be distinguished from the supposed pure Hevea rubber."

The "virgen" rubber of Colombia of which hundreds of tons were exported to the United States of America between 1880 and 1890, obtained by the ruthless cutting down of the trees to almost complete extermination, was obtained from a Sapium identified at Kew as S. biglandulosum (S. aucuparium), but later some doubt has been thrown upon the correctness of this identification.

To reconcile these accounts with our own experiences, two explanations may be brought forward, either that all the trees of S. Aucuparium occurring in the coast lands of British Guiana are comparatively young trees or that more than one distinct species have been included under this name. With regard to the possibility of the former, Dr. C. Bovallius of the Essequebo Exploration Company stated in a lecture delivered at a meeting of the Royal Agricultural and Commercial Society on " Rubber Cultivation in British Guiana," that S. Aucuparium would not give good results at sea level and that it was quite impossible to get old Sapium trees, because when they began to get about ten inches in diameter, they died. Now it is known with many rubber-yielding trees, of which the Hevea brasiliensis is an exception, that the latex of young trees is comparatively poor in rubber and relatively rich in resinous substances, and that not until the the trees have reached a certain age will they yield a good rubber. The same may be the case with S. Aucuparium.

The probability of the latter explanation being nearer the truth will be sufficiently evident to any one who has any knowledge of the extreme variability of the Sapiums and of the confusion of the nomenclature of the species of the genus, which this variability has occasioned.

The third species, Sapium paucinervum is said to yield no rubber on tapping but it is desirable that further trials shall be made before accepting this statement.

To be continued.

A. W. B.

The Right Position to Plant Cocoanuts.

The "Tropical Agriculturist" for September, 1906, gave an account of some experiments carried out by Mr. E. Prudhomme, Director of Agriculture in Madagascar, with a view to determine which was the most favourable position in which to plant coconuts. Mons. Prudhomme sowed five plots of fifty nuts each with all the nuts in each plot placed in a certain position, as follows :—

Plot I.	Nuts placed vertically,				pointed end downwards.
„ II.	„	„	„		pointed end upwards.
„ III.	„	„	on their sides,		pointed end downwards.
„ IV.	„	„	„	„	pointed end upwards.
„ V.	„	„	„	„	quite horizontally.

The nuts germinated in all these positions, but a smaller quantity in some positions than in others, as the following results show :—

Plot I.	...	66%	germinated
„ II.	...	48%	do.
„ III.	...	86%	do.
„ IV.	...	72%	do.
„ V.	...	84%	do.

So the best positions in which to plant coconuts appear to be *on their sides* either quite horizontally or with the pointed end turned downwards, while to plant the nut vertically with the point either upwards or downwards gives the most unsuccessful results.

In Ceylon where the best agricultural methods are generally followed, the planters are almost unanimously in favour of horizontal planting. Another argument in favour of this is that when the nuts fall from the tree and germinate undisturbed it is always on their sides, so that this would seem to be the most natural position.

Mons. Prudhomme tried another series of experiments to ascertain the depth at which the nut should be buried in planting. The results showed that either burying the nuts in soil just up to the middle or level with their tops is the method most to be recommended. The germination of nuts simply placed on the soil without burying was much later than that of nuts which were more or less covered with soil.

Professor J. B. Harrison, the Director of Science and Agriculture, some time back tried some careful experiments to ascertain whether coconuts made the better growth when planted vertically or horizontally. The nuts were all picked from the same tree and were all properly ripe, one half of the number

was planted horizontally, and the other half vertically. When the young palms had reached a fair height, some photographs of them were taken, which show that the nuts planted horizontally have made far better growth than those planted vertically.

There are several people in this colony who regularly plant their coconuts in the vertical position, and one reason they give for this preference is that it enables them to observe more easily when the young plants have been attacked by the "cockles" or coconut beetles. The experiments already described show conclusively that when the nuts are planted in a horizontal position, a larger percentage of them will germinate and that those that sprout make better and quicker growth afterwards.

It is only by making careful experiments of this kind that one is able to find out the best methods in agriculture. Because one man finds that some nuts he has planted in the upright position make satisfactory growth, this is no proof that this must be the best way to grow them. Probably if he had sown an equal number of nuts from the same tree, placing them on their sides, the growth would have been still better.

With regard to the attacks of "cockles," these can only be guarded against by keeping a careful watch on the young plants and examining them at least once a week. Their presence can be ascertained by looking for the large round holes they make in boring into the ground near the sprout. They should be sought for by digging and taken out at once.

The plan too frequently followed by certain farmers is to plant twice as many nuts at half the usual distance apart to allow for a certain number of young plants being destroyed by "cockles." Should all the nuts so planted germinate and a large percentage of the palms arrive at maturity, the superfluous trees are not cut out and in consequence of the crowding the yield of every tree is much reduced.

A. W. B.

Hints on the Management and Care of Sheep.

Before going into the management and care of sheep, I think it my duty to remark that I do not consider British Guiana a sheep breeding country, that is the mud flats of British Guiana. The pastures are entirely too damp, and parasitic diseases too prevalent, the most important being *Strongylosis*, on which I

have already contributed a treatise, to make sheep breeding the great success that it is in many other countries. The methods adopted here in the breeding of sheep are so crude that they can be improved on quite easily, and with great success.

Breeds.—The most suitable sheep for a tropical climate are the Down breeds, on account of their short wool, this breed also possesses high quality mutton, and is very active.

The Flock—Ewes should not be allowed to run with the rams until they are two years old, as before that time they have not properly matured, and it is remarkable what a great difference it will make in the size and build of the progeny if this rule is adhered to, the ewes will also last longer. This rule does not affect young rams as they have not got to undergo the trials and gestation of nursing. The flock should be composed of one-fourth two-tooth ewes, one fourth four-tooth ewes, one-fourth six-tooth ewes, and one fourth full-mouthed and over year ewes.

Improving a Flock.—To maintain a good, strong, and up to standard flock it is necessary that the weaklings should be weeded out every year, and that new blood should be introduced in the way of fresh rams.

Feeding.—The feeding of sheep in this colony is a comparatively easy matter, as we have grass on the pastures the whole year round. As to feeding with grains, that would become expensive, but I am certain it would be advantageous to owners if they fed up their wethers for a few months before selling them to the butchers. I would recommend that rock salt should be kept in the pastures for the sheep to lick whenever they feel inclined.

Docking.—It is important that lambs should be docked when they are about a month old, for it not only improves appearance, but renders them less difficult to handle; it also may tend to broaden the hind quarters. The operation is simple and can be done by anyone. The tail is generally removed close to the rump, or about three inches lower down, according to fashion, and is cut off either with a knife or a sharp hot iron the latter method being the safer as it prevents hemorrhage.

JOHN A. RALEIGH,

Government Veterinary Surgeon.

No. 3,594.

The Cultivation of Broom Corn (Sorghum Dhurra.) *

In planting broom corn, the soil must be well tilled and drained in order to obtain the best results Very little manure is needed, because when the soil is too rich, the plant produces a very coarse and undesirable straw for broom-making. The seeds may be sown in drills 3 feet apart, and the seedlings transplanted three or four in a hole 3 feet square, or a very small quantity of seeds may be sown permanently at the same distance, and when the seedlings are about 6 or 8 inches high, the weaklier ones must be pulled out and planted in those places where no seeds have grown.

The plants grow very slowly during the first five or six weeks, but after that, with favourable weather, they grow so rapidly that they begin to flower in nine or ten weeks, and 3 crops can be reaped in one year. When the ears come clear out of the sheath, and the seeds begin to swell, they become too heavy, and cause the straw to bend under their weight—this natural tendency can be obviated by bending the stalk as soon as the panicle comes out of the sheath. Care must be taken not to break the flower-stalk, as then the straw would not ripen,—this process is known as "tabling." Of course it is only the very long ears that would require this operation. When quality and durability are desired, the straw must be cut green before the seeds are fully matured, and stacked in small bundles in a cool place to be cured by the wind ; the sun gives it a brown colour which lessens its value. Straw of a greenish hue is sold more readily and at a higher price than the brown one. In the manufacture of brooms, the brown straw is dyed green in order to command a ready sale for the article.

There are several varieties of this sorghum, but the best yet introduced are the American, Evergreen, and the Dwarf. The latter grows to the height of about 4 feet, and the straw which is used for making whisks is sold in America at more than a shilling per pound, while the tall growing variety fetches only a few pence. The panicle of the Dwarf variety never comes clear out of the sheath, and consequently the lower part gets stained by insects. A remedy for this would be to spray the ears with an insecticide such as Bordeaux mixture.

Uses.

The straw is used for making brooms, the seeds for feeding animals and poultry, and the leaves and stems make a fairly good fodder.

(Broom Corn is usually considered botanically to be a variety of Sorghum Vulgare Pers.)—Ed.

The seeds when cleaned can be ground into flour and used in the same way as any other corn flour.

A broom which would sell at a fair price can be made by one man in an hour by hand labour.

Cost of materials and labour—14 cents. Brooms can be made at any price to suit the market, and with a fair profit. Colony made brooms have been exhibited for nearly three years and have been pronounced as good as the imported article.

F. G. FITZGREEVES.

The Goa Bean.

A recent number of "The Agricultural Ledger" is devoted to an account of the history, cultivation and uses of the Goa Bean, which rejoices in the botanical name of *Psophocarpus tetr agonolobus*. As a vegetable new to the colony, it is well worthy of cultivation and it is very little trouble to grow. Some seeds of this plant were received from the Director of the Department of Agriculture, Manila, P.I. some months back and the plants raised from them were planted in the model Kitchen Garden in the Nursery, where for some time past, they have been bearing the somewhat peculiarly shaped pods in fair numbers.

The plant is said to grow best in a damp, rich soil. When the plant is grown for its tubers, the land is well stirred and then made up into ridges 2 feet broad and 1 foot high, 1½ feet apart in order to admit light and air and to give good drainage. The seeds are sown in small holes in the ridges about 3 to 6 inches apart. The plant is a strong growing creeper and soon covers the ground. Weeding should be done when necessary.

In about 7 or 8 months after sowing, the tubers are ready to be dug up. The average yield per acre in well-drained soil in the Shan States is given as 49 cwt of tubers, which is valued at the wholesale price at 90s. The tubers are eaten without cooking and are slightly sweet and of a pleasant flavour.

An analysis made of the dried tubers, shows that they are comparatively rich in both carbohydrates (starch and some sugar) and albuminoids.

The plant may be also grown for the beans, in which case it will be advisable to plant the seeds at a further distance apart, say about 3 feet, in holes prepared with manure. When the vines grow they must be provided with a trellis of sticks or bamboos up which to climb.

As the botanical name signifies the beans are provided with four projecting wavy wings. They are picked when not longer than 4 inches and are cooked in the same way as French beans, but their flavour is scarcely as good as that of the latter. Although the

cultivation of the plant on a large scale does not appear to be a profitable industry, yet it is well worthy of recommendation to cultivators, as being easy to grow and producing a good supply of a nutritious food. Lastly being a leguminous plant, the cultivation of it enriches the soil so that in the Singaing township, it is said that the sugar-cane crop if preceded by Goa Beans, yields half as much again as usual. Seeds of the Goa Bean may be obtained on application at the Botanic Gardens.

A. W. B.

Diseases of Coconut Palms.

In October last some specimens of diseased coconut palms from Mahaicony were forwarded to the Imperial Department of Agriculture at Barbados to be investigated by Mr. F. A. Stockdale, Mycologist of the Department. Mr. Stockdale's very interesting report on these specimens has been printed by the authority of His Excellency the Governor as paper No. 397 of the Combined Court.

A fuller report by Mr. Stockdale dealing with the Coconut palm diseases met with in Trinidad was published in the "Official Gazette" for 17th April last.

For the benefit of the coconut planters of this colony whose palms are suffering from the attacks of these diseases, it was thought that a short summary of these two reports might prove useful for reference. They are however strongly recommended to obtain and read the full reports as much that is of importance in these is necessarily omitted in this brief account.

Mr. Stockdale describes three distinct diseases attacking coconut palms, two of which are apparently due to parasitic fungi while bacteria are believed to be the cause of the third.

These diseases are distinguished as:—

1. Root Disease.
2. Leaf Disease.
3. Bud-Rot Disease.

1. Root Disease.

Two out of three diseased palms of which specimens were forwarded to the Imperial Department were found to have the roots diseased.

(*a*) Characters of the disease.—The leaves begin to wither and turn yellow, first at the tips and then gradually all over the leaflets. They dry up, turn black and hang down from the 'cabbage' around the trunk of the tree. Often however the leaves break off and fall down, leaving the sheathing bases still

attached to the trunk. Sometimes the outer leaves wither first or sometimes the middle ring of leaves become withered and yellow, while the leaves above and below are still green. Most, if not all of the nuts on the tree are shed and flowers subsequently produced do not set fruit. In fact the whole appearance of the palm resembles that of a tree suffering from want of water.

Lastly after a number of the leaves have died the terminal bud also dies, falls over and becomes a putrid mass.

This must not be confused with the bud-rot disease, in which, although the bud is decayed, the leaves, stem and roots are healthy. The cause of this disease is a fungus, which has been found attacking the roots, eventually killing them and making them incapable of taking up water and dissolved food material from the soil for the use of the palm, which naturally dies. After the leaves have died and fallen to the ground the fungus breaks out at the bases of the leaf-stalks in a number of minute pustules, which give off a black powdery dust consisting of two kinds of spores—one single-celled and colorless, and the other two-celled and brown.

If a palm attacked by root-disease is cut down a red discolouration will be seen on the cut surfaces of the trunk, which will serve to distinguish a palm attacked by this disease from one affected by bud-rot alone.

(*b.*) Remedial measures.—Although it may prove a very difficult matter to completely eradicate the disease when once it has obtained a foot-hold, several measures are suggested by the adoption of which the amount of the disease may be materially lessened.

The disease may be attacked in the following ways:—

(1) Destruction of all Diseased Material. All dead and dying trees should be cut down and burnt as far as possible. As it is difficult to burn trees containing sap, cutting up and burying deeply with lime is suggested as an alternative. All the leaves and leaf-stalks of the diseased trees should be burnt on the spot.

Rubbish such as husks, etc., must not be allowed to accumulate in an infected area and form a possible breeding ground for the fungus causing the disease. The stump of the diseased tree and as many of the diseased roots as possible must be destroyed as the fungus can live in the old roots. Also old trees and rubbish form a breeding ground for beetles.

Mr. Stockdale lays stress on the importance of all the cultivators of coconuts in a district combining to destroy diseased material, because if this precaution is neglected in one estate, it will remain a permanent source of infection for

neighbouring cultivations. The disease shows a marked tendency to spread rapidly from centres of infection.

The opinion is also expressed that it should be made compulsory for every cultivator of coconuts to destroy by fire or otherwise all dead and decaying trees on his grounds.

(2) Isolation of Infected Areas. To prevent the mycelium of the disease from spreading through the soil, diseased areas should be isolated by cutting trenches 12-18 inches deep around them. The soil taken from the trenches should be thrown inside, not outside the area, and the trench should be made to include several apparently healthy trees round the area, as the fungus may have spread further than is noticeable.

(3) Resting of Infected Land before Planting Supplies.

The areas from which diseased trees have been removed should not have fresh coconut palms planted in them for at least a year. Some other crop may be grown instead or the soil improved by ploughing and planting leguminous plants.

(4) Spraying and Application of Chemicals. The fungus remaining in the soil may be destroyed by the use of lime, for which purpose unslaked lime is the better.

Spraying the surrounding palms with Bordeaux mixture may prevent the disease from spreading to them.

(5) Improved Cultivation and Drainage. As this is mentioned as an important preventative in all three diseasee it will be referred to later.

(6) Searching for and Propagating Disease-Resistant Varieties. Though no varieties of Coconut palm have been noticed so far as completely resistant to the disease, yet some kinds may be found which are comparatively less liable to be attacked than others though growing in disease districts. These must be sought for and propagated.

2. Leaf Disease.

Characters of the Disease:—The disease appears first as small yellowish spots on the leaflets, especially near their tips. These yellow spots gradually increase in size. The leaflets towards the tip of the leaf are usually the first attacked and they gradually become dry and withered. Later the disease spreads to the other leaflets towards the base of the leaf. If the leaf attacked is growing more or less pointing upwards, when the top 2—3 feet of it have been attacked and become withered this part of the leaf breaks down and remains hanging from the healthier portion. This is very characteristic of the disease. When several leaves

have been attacked, the number of nuts borne by the tree diminishes and finally no nuts are set. In time the death of the palm results.

The disease is due to a fungus known as *Pestalozzia Palmarum, Cooke.* The effect of this fungus is to kill the leaves and stop them from manufacturing food for the use of the palm and hence both the supply and the size of the nuts borne by the tree are diminished.

Remedial Measures :—As in the case of the root disease, all dead leaves, trees etc. should be carefully collected and burnt on the spot. In any case the leaves and leaf-stalks must be burnt. Trees showing only a few diseased leaves should be climbed and the diseased leaves cut down and burnt ; such trees should be examined again regularly once every fortnight for further signs of the disease. A good forking around the tree and the application of manure will help a diseased tree to throw off the attacks of the fungus. The disease should also be searched for on trees surrounding a diseased one. Spraying with Bordeaux mixture would probably be effective in keeping the disease in check, but it is not known how frequently it will be advisable to do this. The disease is at present only doing serious damage when the conditions of the soil and cultivation are unfavourable, and therefore such points as drainage, manuring and cultivation should be carefully attended to.

3. BUD-ROT DISEASE.

Characters of the disease :—In a coconut palm attacked by this disease the roots and stem appear to be quite healthy while the bud is attacked by a soft rot possessing a putrid odour. The disease is indicated by the youngest visible leaf, still unfolded at the top of the palm, turning brown and withering. Sometimes the withered leaf topples over so that it cannot easily be seen from below. The disease spreads outwards attacking the next youngest leaves in succession. Sometimes however, it was observed that the lowest and oldest leaves, or the middle leaves showed the first signs of being unhealthy.

After a time the terminal bud falls over, frequently leaving a ring of quite healthy-looking leaves at the top of the trunk.

If a diseased tree is cut down and the bud cut open, instead of the white cabbage a pale brown foul-smelling semi-liquid mass is found occupying the centre. The disease is believed to be due to bacteria, which have been found in abundance in the rotting tissues, together with some fungus mycelium.

Remedial Measures :—If the trees are attacked by only bud-rot disease, it is recommended that the top 4 or 5 feet be cut off and

buried deeply with lime as it would be impossible to burn the soft, rotten, diseased buds. The remainder of the trunk and all rubbish should also be collected and burnt. Here again it will be necessary for the planters to take united action in destroying diseased trees, so as to remove all centres of infection from which the disease may spread.

Remarks:—Of the three diseased palms of which specimens were sent to the Imperial Department for examination two were found to be suffering from a disease of the roots, while the third showed evidence of bud-rot. The fungus causing the leaf disease has been observed on several occasions on coconut and other palms cultivated in British Guiana by two or three observers, including the writer of this summary. Before deciding what measures to adopt for the destruction of diseased palms, it is very important to ascertain with certainty from which disease the palms are suffering, to know which part of the palms—the roots, the leaves or the bud—it is most necessary to destroy to prevent the disease from spreading. The characters of the different diseases should be carefully noted, the possibility of a palm being attacked by more than one of these diseases at the same time and hence showing a combination of characters, being continually borne in mind. If there is any doubt as to the exact nature of the disease in any particular palm or palms, application for assistance should be made to the Science and Agriculture Department.

If steps are not taken to stamp out these diseases and if they are allowed to spread further, the loss of most of the coconut palms in the colony is threatened.

In his suggestions of remedial measures for combating coconut palm diseases, Mr. Stockdale repeatedly insists on the importance of improved drainage and cultivation as one of the best safeguards against the attacks of disease.

In the Mahaicony district where coconut diseases are very prevalent and have caused the death of a large number of coconut palms, it is almost impossible to imagine a worse condition of neglect than is shown on many of the estates. In the first place the drainage is often faulty, and the whole cultivation is taken over by weeds and bush, wild creepers being allowed to grow over some of the palms. In places heaps of decayed husks or fallen palm stems are left to become fruitful breeding-grounds for fungus diseases and insect pets. No care appears to be exercised in selecting or planting the nuts, any nuts which fall from the palms and are overlooked are allowed to sprout and grow into trees where they fall, whatever the size of the nuts or however close they may be to other trees. The effects of this carelessness were observable on examining a quantity of the nuts husked and waiting to be sold, in the large

proportion of them which were of very inferior size. Many of the estates cover a large area and must contain many thousands of coconuts palms, mostly fruiting, each estate representing a valuable property capable of yielding a good return in the way of annual income for a number of years, if properly looked after.

But the totally neglected condition of many of the cultivation is not only such as to court and encourage the attacks of any disease to which coconut palms may be liable, but must result in steadily depreciating the value of the property.

A. W. B.

The Use of Lime in Agriculture.

An interesting article on the above subject by Mr. F.. B Guthrie appeared in a recent number of the Agricultural Journal of New South Wales, of which the following is a short summary.

Mr. Guthrie remarks that there are few soils which will not derive benefit from the application of lime, even when the soil already contains a fair proportion of this substance. The lime is beneficial rather as a means of improving the land than as a direct plant food.

It is particularly beneficial on the following soils :—

1. Soils deficient in lime.

2. Sour soils, which it sweetens by neutralizing the acidity, especially on land newly turned up or on swampy land.

3. On stiff clay soils. The lime makes them lighter and easier to till.

4. On sandy soils which lime helps to consolidate and to increase their power of holding water.

5. On lands where peas or beans or other leguminous crops are to be grown.

Nature of Lime.

Lime, or " white lime " as it is usually called in this colony, is made by burning limestone or chalk in large kilns. When freshly burnt lime is mixed with water, it becomes very hot and crumbles to a powder, being then known as slaked lime. There is usually sufficient moisture in the air to change burnt lime to slaked lime after a short time without the addition of water.

Action of Lime on Different Soils.

The action of lime upon a clay soil is to coagulate the the very fine particles of the clay into larger particles which do not stick together so closely so that they are better able

to allow water to circulate in the spaces between them. Lime also prevents a clay soil from cracking in dry weather and becoming sticky in wet weather. Limed land is drier and warmer, more friable and and so easier to cultivate.

On sandy soils lime acts in much the same way as it does when it is mixed with sand to make mortar, only to a far less degree. In making mortar one part of lime is mixed with usually three to four parts of sand whereas a ton of lime spread on an acre of land represents one part of lime to 20,000 parts of soil. The lime causes the particles of sand to stick together so that they are better able to hold water in the spaces between them

Lime which has not been slaked or only freshly slaked is better than ordinary slaked lime.

The chemical action of lime upon the soil is partly to neutralize or destroy any acids the soil may contain. It also helps to some extent in the production of plant food and in converting certain plant foods in the soil into a condition in which they are more easily taken up by the roots of plants.

Method of Applying Lime.

Lime should be applied as evenly as possible over the land and ploughed or forked in very lightly. The land should be left alone for two or three weeks after liming and no seed sown or manure (especially these containing nitrogen, e. g. pen manure, or superphosphate) used during that period.

A. W. B.

"Washiba," A Valuable Timber.

In No. 2, 1907, of the "Bulletin of Miscellaneous Information" of the Royal Botanic Gardens, Kew, the following note appeared in an article entitled "Economic Notes: Liverpool," by J. M. Hillier, relating to various economic products which reach that port.

"Washiba, a tough and elastic wood of a reddish brown colour, imported from British Guiana, was also noted. This wood is used for making bows, fishing rods, etc. and *in this country is in demand for wheel-spokes.* Washiba has been long known in commerce in this country, but although efforts have been repeatedly made by Kew to trace the botanical source of the tree which yields the wood, the point has not yet been satisfactorily settled."

In the Report on the "Woods of British Guiana" by M. McTurk Esq., C.M.G., Washiba is thus described :—

"No. 54, Waciba, Washiba or Bow-wood from the Isororoo Creek, Upper Pomeroon River. Waciba grows to a large size

but it is a rare tree and little known. Its wood is of an olive colour, is exceedingly tough, hard and close grained, and is the best known wood for bows. Its average height is about 120 feet and it can be had to square 30 inches, free of sap."

The description of the colour of the wood quoted from the the Kew Bulletin of Miscellaneous Information does not agree with the account in Mr. M. McTurk's Report also mentioned.

In " The Timbers of Commerce " by Herbert Stone, Washiba is thus described :—

" Colour. Heart-wood rich reddish-brown " a beautiful red splashed with yellow, satiny," well but not sharply defined from the brownish or yellowish-white sap-wood which " is two feet thick to one of heart, white, hard, heavy and compact."

I have examined the specimens of Washiba in the collection of Colony woods, both at the Institute of Mines and Forests and in the Museum of the Royal Agricultural and Commercial Society, and have seen some of the Indian bows said to be made of the wood and I find that they agree very closely in colour with the description just quoted. So that either there are two varieties of this wood or the wood becomes darker and undergoes a change in colour with age, a character found in many other woods. Whatever may be the explanation it is evident that it is the wood of *a reddish-brown colour* for which there is said to be a demand in England.

On account of the demand which is said to exist for the wood in England because of its suitability for the manufacture of wheel-spokes, it will probably be worth the while of anyone engaged in cutting timber on grants in this colony where the tree occurs, to endeavour to obtain and ship this wood. Because of the scarcity of the tree in the forests there is little likelihood of the demand for the timber being satisfied and shipments should obtain a good price.

A. W. B.

Hints on the Cultivation of Para Rubber.

The Seeds and Sowing.—The seeds of Para Rubber quickly lose their power of germination so that it is essential if they have to be kept for some time or are required to travel for some distance that they should be mixed with powdered charcoal which has been slightly and uniformly damped. Packed in this substance in tins with close-fitting lids, *e.g.*, 1 lb. biscuit tins, a large percentage will be found to germinate after a voyage lasting several weeks.

In ordering Para Rubber seeds from abroad even when large quantities are required, I would strongly advise that they should be sent packed in tins, each under 11 lbs. weight by the Parcel Post, thereby insuring as speedy a delivery as possible. If shipped as freight by goods steamer the probability is that they will be delayed either in transit or in transhipment and on arrival none or only a small percentage will germinate.

The former method of obtaining them though probably the more expensive, will usually be found to be the more economical and satisfactory in the end. It is scarcely necessary to add that the seeds must be sown as soon as they arrive.

Coconut fibre in boxes or beds is a good material in which to germinate the seeds. A mixture of saw-dust and leaf-mould in equal quantities has been successfully employed, or sand could be substituted for the saw-dust when the latter is unobtainable. Probably any soil which has been made light and loose by a good admixture of leaf-mould will serve the purpose.

The seed-beds must be kept well-watered but should be protected from heavy rains and must be shaded from the sun.

When the young shoot has grown up straight and before the leaves expand the young plants should be either transferred into baskets or planted 6 to 8 inches apart in nursery beds of good, loose soil. The former method is the one recommended both because the plants are easier to handle and to move about and because there is less danger of injury to the root system when they are planted out in the field.

Planting Operations.—Mr. Herbert Wright's book on planting Para Rubber recommends that the seeds should be planted out as soon as they have germinated. Our experience here, however, has been that most plants make better growth afterwards, if kept for a time in the Nursery, where they can be provided with lighter and richer soil and better drainage to encourage the

development of a good root-system, than if planted out in our heavy soil and exposed to heavy rains. Also the plants will be less liable to be injured by grasshoppers and other insects if they have had time to harden in the Nursery before planting out.

In Ceylon the young plants are very liable to be attacked and destroyed by rats, pigs and various herbivorous animals, so that either the whole cultivation, or the individual plants often require to be protected by wire-netting or other means.

Good drainage is as necessary for the successful growth of rubber trees as for other plants, especially if the land is low and swampy.

Planting should always be done in the rainy season. The holes should be dug 1½ feet deep and 2 feet across. To give the plants a better start the soil should be taken out of the holes well mixed with leaf-mould or well-rotted manure and then put back so that it forms a small raised heap above each hole.

This can be left for a fortnight or longer to settle and then a hole is made in the top of the heap large enough to contain the ball of earth round the roots of the plant. After planting and filling in the hole the earth should be well pressed down around the roots.

If the young plants are liable to be exposed to any wind, it will be advisable to tie each to a short stake firmly driven into the ground, after it is planted.

Planting Stumps.—This method of planting appears to be extensively employed in Ceylon. The plants are kept in Nursery beds until they are from 6 to 12 months old or have reached a height of about 3 feet. They are then pulled up in wet weather when the ground is well soaked, the leaves, small roots, the end of the tap-root and the top shoot are cut off with pruning scissors and the bare stumps are transported in bundles of about 100 each to the place where they are to be planted.

The advantages of these stumps are that they can be transported succesfully for long distances and that when planted they will retain their vitality for many months, even under unfavourable weather conditions. On the other hand the rigorous pruning back must check the growth of the plant to a certain extent.

Distance in Planting.—There is considerable difference of opinion as to the proper distance apart to plant Para Rubber which appears to depend partly on local conditions and partly on whether it is intended to grow other crops between the *Hevea* trees.

In Ceylon the distance apart of the trees on the different estates varies from 10 feet to 20 feet. The main objection to too close planting is that it induces growth in height instead of in circumference and thereby considerably delays tapping operations, which cannot be started until the trunks are of sufficient thickness.

A distance of from 15 to 20 feet apart each way has been recommended, thinning out alternate trees afterwards, when the spreading roots begin to interfere with each other.

If an estate is to be planted in rubber alone, the trees can be put 10 feet apart and when they are six years old, individual trees can be tapped until they die and thus make room for the further growth of the remaining trees.

One great advantage of close planting is that by the increase of the number of trees to the acre the available tapping area of tke trunks per acre, is also considerably increased.

The following table shows this :—

Distance apart of trees in feet.	Number of trees to the Acre.	Available tapping Area per acre at end of 4th or 5th year in square inches. Base to 5 feet high
10 x 10	435	522,000
10 x 15	290	348,000
20 x 20	109	130,800.

On an estate planted 10 feet by 10 feet about 5 per cent. of the trees could be tapped to death at the end of the 4th year and a larger proportion dealt with likewise each succeeding year until by the end of the 8th year an average of about 250 trees per acre would remain. Also in planting close at the beginning the trees shade the soil more quickly and thus keep down the expense of weeding.

Shade and Protection from Wind.—Para rubber trees grow better if shaded lightly after being planted for the first and second years; afterwards they do not require shade. The necessary amount of shade could be provided by putting in a sucker of some tall-growing variety of Banana, such as the "Apple" or the "Jamaica," midway between every two plants when they are 10 feet apart. Although pigeon peas would be more beneficial to the soil, the young Para rubber plants grow so quickly that they would soon overtop them.

Shelter from the wind is only necessary during the early stages except in very windy places, owing to the protection which the mature trees give to one another and their general strength.

Inter and Catch Crops.—In planting catch crops between rubber trees, stress must be laid on the importance of not putting them too near the rubber trees, so as to interfere with the roots of the latter and hence impede their growth. The rule is that a radial distance of one foot should be allowed for the growth of the roots of the rubber trees for each year that they have been planted and catch crops must not be grown within this area. Thus a space of one foot radius must be left clear round one-year old rubber plants, a circle of two feet radius round two-year old plants and so on.

Bananas can be recommended as a good catch crop, for besides the possibility of exporting the fruit, they afford a suitable shade for the young plants, as mentioned previously.

Cocoa is planted with Para rubber as an inter-crop in Ceylon and Coffee in the south of India.

Both would suit local conditions but it is essential that they should be planted at the same time as the Para rubber, as the root-system of the latter is strong and quickly takes possession of the soil. In the case of Cocoa it is advisable to allow sufficient room for the roots of both for the first five years by planting both 20 feet apart each way which will give about 100 of each to the acre.

If Coffee is used as the inter-crop, the coffee is planted 10 to 12 feet apart and the rubber plants 20 to 24 feet apart.

Green Manuring.—Leguminous plants can be profitably employed during the first three or four years for improving the soil and for keeping down weeds. Where the soil is sufficiently light, ground nuts may be advantageously used for this purpose and pigeon peas or dholl in other places.

Pruning.—In a recent number of the "Tropical Agriculturist" Mr. Herbert Wright suggests that the trees should be topped when they reach a height of about 12 feet by removing the terminal bud with the thumb-nail or a knife, and the two side-branches be allowed to develop and grow upwards. In about six weeks' time when these are each about a foot in length they can again be pruned and a half-a-dozen shoots allowed to grow from each. In four or five months' time when these shoots are four to six feet in length, they may be finally pruned at the apex and allowed to develop as many branches as possible.

Thus in about six months' time a tree will be produced with a stem 10 feet in height and twelve branches. Hence the number of leaves and consequently the food-producing power of the tree will be twelve times as great as for a tree of the same age which has been allowed to grow with a single stem.

Mr. Wright claims that the result of this treatment is that the trees form trunks which are thick enough to be tapped in the fourth year. Further he points out that when the trunks of the trees are kept to this height the cost of the labour required for tapping is much reduced.

With regard to the earlier yields to be obtained by this method, it is of great importance to endeavour to place the rubber on the market as soon as possible while the prices continue high and before the increased supplies of plantation rubber from the numerous rubber trees which are being planted extensively in various tropical countries, cause the inevitable fall in prices.

A. W. B.

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The Native Rubber Trees of British Guiana.—(Continued).

Suggestions for Improved Methods of Collection of Rubber from Sapiums.—Almost the whole of the Sapium rubber exported from British Guiana has been collected by the Indians. The trees are so scattered in the forests and the individual trees are, as a rule, so far distant from each other that it is extremely questionable whether it will be profitable for anyone, except an Indian, who, as a rule, is accustomed to set little or no value upon his time, to make a business of collecting the rubber himself, as is done with the Para rubber in Brazil. The actual collection of the rubber cannot, however, occupy much time, as all that the Indian has to do is to make cuts on the bark with a cutlass to allow the latex to exude and to return to the tree some hours later to collect the rubber which has coagulated on the bark in the form of strings. These strings are then detached from the bark and wound up tightly to form balls, as already described. Many improvements might be effected in this very crude method of collecting and the few following suggestions are offered:

(1). The bark should be scrubbed or brushed clean before tapping, of all loose particles of moss, dirt, etc., which might adhere to the rubber and depreciate its value.

(2). When the rubber is collected in balls, these should not be made more than about three inches in diameter, as the larger balls are apt to become soft and, sticky inside. The objection to these balls, however is that they can be very easily 'doctored' by placing a stone or other foreign substance in the centre, the presence of which can only be detected by cutting open the ball. A better method, which I have seen recently employed is to incorporate the strings into the form of flat cakes of about half-an-inch in thickness. The rubber being able to dry more easily is not so apt to become sticky, and at the same time, the buyer is better able to observe the quality of the rubber throughout and to satisfy himself that it includes no foreign substances. I have been informed that the rubber in this form obtains a better price than that collected in balls.

(3). The tapping can be better and more expeditiously accomplished by the employment of a proper tapping-knife, than by the usual cutlass and with far less injury to the trees. Mr. Beckett found that a tool known as the Safety Tapping Knife, was admirably suited for the purpose. The cost of this tool is 3/4 and it can be obtained from Messrs. Brown & Co., Ltd., Colombo, Ceylon.

According to Mr. Beckett's experience who has tried collecting and coagulating the latex in shallow vessels after the usual method of preparing rubber, the Indian method of collection appears to be the more expeditious. The difficulties which Mr. Beckett experienced were first, that the latex is apt to coagulate very quickly on the tree preventing its further flow, and, secondly, the latex after collection, mixing with water and straining took from three to five days to coagulate.

The employment of drip-tins, as used in Ceylon for the same purpose, will probably overcome the first difficulty. A drip-tin is a small funnel-shaped receptacle containing water, usually made out of tin, as its name implies, which is fastened to the tree above the cuts. Through a small hole in the bottom of the tin, the size of which can be regulated, the water slowly and continuously drips on the cut surfaces preventing the latex from coagulating on them and choking up the laticiferous tubes.

With regard to the slow coagulation of the latex after mixing with water, this could probably be considerably hastened by the addition of a small quantity of one of the chemicals, *e. g.*, acetic acid or formic acid, which have been found effective for the purpose.

Suggestions for Cultivation.—For the purposes of cultivation Sapium Jenmani is the species recommended. As I have already pointed out there is good reason for thinking that all the rubber hitherto obtained has been gathered from this tree. Observers agree as to the rapid growth of the tree, though it is not known at what age the trees can be first profitably tapped.

I do not think that it will be advisible to attempt planting the tree in the immediate neighbourhood of the coast, where this species does not appear to thrive. A short distance inland, away from the sea-breezes and where the soil, though frequently swampy, is lighter in texture, will probably suit the tree better.

The seeds can be obtained from about March to May and the ripe ones can be recognised by their red colour. On account of their comparatively small size they will only require a light covering of soil after sowing. The young plants are also to be found springing up in the neighbourhood of the trees, where sufficient light is admitted into the forest. They are very hardy

and will endure lifting and transportation well, if the soil around their roots be disturbed as little as possible and the roots are kept damp.

Another method of propagation which has proved very successful when tried on young trees growing in the Nursery is by "ringing" the younger branches in the same way that rose trees are often propagated.

As the fully grown tree reaches a huge size, I should not recommend planting closer than 20 feet in both directions. If the trees are planted on land already cleared, some light shade in the form of plantains or some tall-growing banana will probably be beneficial, and the land between can be used for growing other crops.

Where however it is desired to plant S. Jenmani in uncleared forest land, an experienced forester who has lately been visiting British Guiana did not advise clearing the land for the purpose, as it would soon be followed by a growth of weeds and bush which it would be expensive to keep in check. He recommended the clearing of narrow, straight lines in the forest running parallel with each other and at approximately regular distances apart, *e.g.*, 20—25 feet, and planting the trees at uniform distances along these. The shade would keep down the growth of bush and weeds over the greater part of the land and would assist the growth of the Sapiums. As the latter increased in size, the forest trees would have to be cut down to make room for them. For these same reasons he considered that it would be cheaper to plant Sapiums in the uncleared forest according to the method advocated above than to plant them on land already totally or partially cleared.

At the present time only one planter in the colony has been putting in Sapiums to any considerable extent. This man is the owner of a large grant on the Aruka River and he has planted over 15,000 trees on his property, which he reports are making good growth. Several of his neighbours are now copying his example and most of the cultivators along this river have each their own little rubber cultivation.

HEVEA.

The Heveas can be readily distinguished from the Sapiums by the leaves being compound, instead of simple as in the latter, *i.e.*, each leaf consists of three distinct leaflets, borne at the end of a long stalk and each leaflet is provided with a short stalk of its own.

All the Heveas are forest trees, exuding a milky juice when any part of the tree is wounded or cut. On the upper surface of the main leaf-stalk, at its apex where the three short stalks of the leaflets arise, are usually to be found a few rounded glands, appearing as small depressions with raised margins. Their number varies in the different species from two or three to as many as four or five, but sometimes they are wanting. Their presence and number is of some value in discriminating between the different species.

The flowers of Hevea are arranged in branched panicles and are small and green. As in Sapium they are destitute of petals, and there are distinct male and female flowers, the latter being rather larger than the former and mostly borne at the ends of the branches of the inflorescence. The calyx of each flower has five teeth or lobes.

The male flowers contain 5 to 10 stamens arranged in one or two circles round a central column. The female flowers possess a more or less egg-shaped ovary with three divisions, each of which contains one ovule. When the ovary ripens it forms a large woody capsule, which at maturity splits open with a report into three valves, scattering the seeds to some distance.

The seeds are large and rounded and somewhat oblong in shape In Hevea brasiliensis they measure an inch across the largest diameter. The seed-coat or testa is smooth and rather thin ; it is usually of a gray colour mottled and streaked with irregular brown markings. The seeds lose their power of germination very quickly, but they may be preserved for as long as two months, packed in charcoal which has been slightly damped. When sown the seeds germinate in a week or ten days' time and the young plants are of rapid growth.

The Heveas which include about twenty species are all found in the tropical regions of South America. The only species hitherto recorded from British Guiana are *Hevea Spruceana, Muell. Arg., H. pauciflora, Muell. Arg.* and *H. confusa, Hemsley.* The true Para Rubber (*H. brasiliensis, Muell. Arg.*) does not, so far as I am aware, occur within the boundaries of the colony. *Hevea guyanensis Aublet*, the first species to be described, is a native of French Guiana.

There is still a lot of confusion between the different species of Hevea and they are by no means easy to discriminate, without, in most cases, a careful dissection and examination of the flowers under a magnifying glass, so that it is of little use attempting to describe the characters by which they can be recognised, nor is it of much importance to be able to distinguish between the three British Guiana species.

The only specimens of H. Spruceana we have in the Botanic Gardens Herbarium, are some collected by the late Mr. Jenman in 1886, on the Essequibo river above Bartica. H. confusa and H. pauciflora are fairly widely distributed throughout the colony, having been found at some distance up the Essequibo, Mazaruni and Demerara rivers, and there are also several trees to be found scattered along the Tapacooma creek.

The trees are invariably found growing most abundantly in the low, swampy lands, fringing the sides of the smaller creeks, which during the wet season are subject to periodical inundations. Mr. Jenman mentions that the names applied to the Heveas among the various Indian tribes are, *Arawack*, Hattie:—*Carabisi*, Poomui:—*Ackawoi*, Sibisibi, but the Arawack name is the one by which the trees are most generally known. The trees flower from October to December and ripen their seeds in the months of April to June.

Rubber from Heveas.—Not one of the British Guiana Heveas is known to yield a rubber of any commercial value. The samples of the 'rubber' which have been collected and submitted for examination from time to time have all been found to contain a large percentage of resinous matters, and analyses of the latex show only a very small percentage of caoutchouc. If any means can be discovered by which the latex can be coagulated into rubber with the elimination of the resin, it may be profitable to work the trees.

In certain parts of the colony these Heveas are very numerous. In a report on a visit made to the Manabadin Creek on the Demerara River at the beginning of the present year by Mr. R. Ward, Agricultural Superintendent, in the summary Mr. Ward states that he found three species of Heveas in this Creek, all confined to the low, swampy, flat lands. He says further that the Creek appears to run several miles inland with two tributaries a considerable distance apart from one another, and that Heveas are said to be plentiful throughout this large area. The portion that he examined gave an approximate estimate of 200 trees to the acre, with an average diameter of ten inches per tree, and young seedlings and medium-sized trees were common all along the banks of the Creek. Mr. Ward also mentions that he received information of another Creek some distance below Manabadin where the Heveas were again plentiful.

So that it appears desirable that the whole question of the occurrence, relative abundance and rubber-yielding capabilities of the native Heveas should be thoroughly gone into, as little or

and of wonderful richness in caoutchouc. In some cases as it rushed out it formed threads and hung in running fibres from the branch to the cup. On several occasions I noticed that, instead of milk, pure liquid caoutchouc seemed to run. No doubt the dryness of the weather at the time, less water being consequently present in the bark, had much to do with this result, and with the impression produced on my mind of the richness of the milk in pure rubber."

"In straining it afterwards in a perforated tin to separate bits of bark that had dropped in, the milk formed a covering of caoutchouc over the bottom of the vessel in the very brief time that it was running through, only a few seconds.

From the stem, tapping it as high as the first branches of the tree that had supported it, 30 to 40 feet, we obtained a quart bottle of milk and quite as much more was wasted by our hasty work, in dripping on the ground after the cups were removed from the old to new cuts and by coagulation in the fissures, besides all that was left in the bark."

Mr. Jenman found that on tapping again the plant bled the previous day, the milk again ran freely but not so freely as when first bled. Judging from what he observed on subsequent visits, he considers that on the first tapping, unless it be done very thoroughly, only about a fifth or a sixth of the milk is procured.

The time taken to coagulate a quart bottle of the latex into rubber, so as not to be sticky when handled, in a tin pan about 10 inches in diameter, shaded from the sun, was six days. The rubber was then washed in the usual dark-coloured creek water which Mr. Jenman says seemed to produce some unfavourable chemical action, for it was sticky and dried very slowly subsequently.

Report on the Rubber.—The sample obtained was sent to the Director of Kew Gardens, who submitted it for report to the India-Rubber, Gutta Percha and Telegraph Works Company, Limited.

According to the report furnished, the substance was said to have many valuable properties, but the quantity sent was too small to determine its value satisfactorily. It contained a large percentage of caoutchouc, but on removing the resin, the former was obtained in a soft, sticky condition unfit for manipulating as india-rubber, The concluding sentence of the report runs,— "When a substance of such promise is sent for examination, it is not only important that a large supply should be available for the purposes of a preliminary examination, but for subsequent

experiments ; frequently an application has been found for a vegetable product by accident, from being able to fall back upon it, as it were, when an opportunity presents itself."

This interesting report on macwarrieballi ends with a request to balata collectors and wood cutters that they would endeavour to procure and send him (Mr. Jenman) a few pounds of this new rubber for trial. He deplores the extent to which the practice has grown, of mixing the milk of this and of various other trees capable of yielding rubber or gutta-percha with the balata milk, which he considers must cause a deterioration in the product obtained, causing perplexity and trouble to the manufacturers.

"The object of collectors and exporters alike should be to endeavour to gain a market reputation and demand for each of our several rubbers and guttas, allowing each one to rest upon its own merits and so determine the intrinsic value of each. By the present system of mixing the milk of all kinds together, they are probably inflicting unwittingly a permanent loss on their work in modifying the quality and hence the value of the balata or rubber exported."

This advice would appear to be of special importance now, nearly twenty years after the above was written, as the demand for and consequently the value of every kind of rubber has increased so considerably.

A. W. B.

Importance of Early Attention to Plant Diseases.

The following remarks made by Mr. J. B. Carruthers, F. L. S., Director of Agriculture of the Federated Malay States, in his Annual Report for 1906, on the importance of keeping a careful watch for the first out-break of any pest or disease on rubber estates and when any is found taking immediate steps for its destruction, appear to me to be worth quoting as very applicable to the planters of this colony.

I have in my mind's eye at the present time two instances, one of an insect pest, the other of a disease due to a parasitic fungus, each of which was responsible for damages to a particular crop amounting to hundreds of dollars. Both of these diseases could easily have been arrested at their first appearance, at a small cost, had the owners of the cultivations applied to the the Department of Science and Agriculture for assistance instead of waiting until the disease or pest had obtained a foothold.

Mr, Carruthers writes as follows :—

"The general health of rubber trees of all ages, from seedlings to 25 year old trees, has been during 1906 excellent. Diseases have occurred in nurseries and on older trees but not affecting a very large number of cases or a large percentage of trees on any except two or three estates. The rapidly increasing area of rubber, with its thousands of trees added monthly, means an increased danger of spreading disease, and should bring with it an increased vigilance with regard to the first signs of disease and promptitude to take steps to prevent it growing any further. I have prepared a pamphlet entitled "First aid to plants" which will be circulated among planters giving briefly the methods to be employed at once in any cases of suspected disease either of insect or fungal origin. The importance of this branch of the routine of an estate cannot be too often or too forcibly preached.

My experience of nearly ten years' investigation of and fighting with diseases of cultivated plants in the tropics leads me to the belief that the policy of waiting to shut the stable door until the horse has gone is still not unusual even with the most capable and practical planter.

Pests both fungal and insect, must come in every cultivation, and no plant, however vigorous or with the most perfect con-

ditions for its growth can be considered as not liable to contract some disease. These occasional deaths of plants may, if unattended to, eventually cause most serious loss.

The scientific officers of the department can be of much help to agriculture in the direction of investigation of diseases in cultivated plants with a view to their prevention and cure. Unfortunately the importance of the plant doctor is not yet recognised as fully as that of the medical man or veterinary surgeon. This is to a great extent because the fact is not realised that all lack of health or vigour is due in plants, just as in man, to specific causes either of environment or to the attacks of insects, fungi or bacteria. The past history of plant doctoring is not entirely a succession of triumphs over disease, but it compares very favourably with the results obtained in human medicine, and should by this time have secured the confidence of the planter, farmer or gardener.

In order that the technical knowledge of the officials may be most utilised, it is important that early information as to the outbreak of any pest is sent to the department and specimens of all stages of the disease, with as much information as the superintendent can give as to the first signs, the conditions of the field, if well drained or with water very near the surface, the age of the trees attacked, whether the disease was noticed first in one place or at different centres, how quickly it has spread, and all other observations which have been made. A full letter, even though it contains some things that may seem trivial and of little use, is of much greater help than the sending of a short note with a single leaf and the request " I am sending you a specimen of disease I have noticed on my rubber, will you let me know if it is likely to be serious and what measures I should take to prevent its spreading."

Rules for Pruning Cacao.

The following directions for pruning Cacao by Mr. J. H. Hart, F.L.S., Superintendent of the Botanical Department in Trinidad, appeared in the Bulletin of Miscellaneous Information for July last. It is scarcely necessary for me to remark that Mr. Hart is a well-known authority on the cultivation of Cacao, his treatise on the subject being a standard work, so that everything that he has to say on this matter is bound to be of very great importance to all who are in any way interested in growing Cacao.

"Much has been said and written on the pruning of Cacao, but this work, although such an important one, is yet left largely to those possessing an insufficient knowledge of plant life and hence in many cases the system carried on is one merely of hacking and "lopping," resulting in mutilation, and engendering the production of rotten centres and holes in the stem, which strongly invite the attack of Parasitic Fungi. Probably there is no remedy for this state of things until the planter himself recognises to the full the importance of maintaining his trees without resorting to the crude and haphazard methods of antiquity which are in so many instances the only practice followed

The scriptural advice to "train up a child in the way he should go and when he is old he will not depart therefrom"—is as applicable to a Cacao tree as to a child.

Pruning should begin in the youngest stages, when branches are small, and can be cut off without making wounds of any size. It should not be allowed to make large and misplaced branches which have afterwards to be cut away, causing large wounds, and loss of vitality and growing material, for it is easy to see that this material together with the sap, &c., that is required to produce a fair size branch, is all lost when it is cut away, while if the efforts of the tree had been properly directed in an earlier stage, there would have been no occasion to cut, and the material lost, would have been otherwise expended in the growth of suitable and well placed wood. Generally speaking, this applies to all Cacao trees, in fact, to all kinds of trees whatever.

The system now coming into general use of allowing more stems than one to a Cacao tree is one, to which nature shows the way; and therefore why should the cultivator cut ruthlessly away under the European idea that one stem is *the only* way—when it is seen that by allowing a due proportion of such

stems to develop he obtains, not only larger annual crops but a more regular crop month by month throughout his plantations.

What is cut away should be cut away *young*, so that growing material should not be wasted but directed into other channels for the production of wood or fruit. The aim of the planter should be *never to allow the cutting away of large branches.* It is recognized however that it is impossible in practice to adhere to such a standard of procedure as at times it is necessary for special reasons to remove large branches, but the fewer, the better, and when removed, the antiseptic treatment of wounds should be regularly adopted.

There is much more to be said about Cacao pruning, but this must be deferred to a later date, but planters should allow themselves to be advised, that the proper care of their trees, and attention to wounds and wind fractures is one of the surest ways to maintain their trees in health, and thus prevent in a large measure the insidious attack of the many parasitic Fungi, which are always present. Attention to the Hygiene of the tree is of as great importance, as attention to personal cleanliness in mankind, and has far more to do with the maintenance of health, than the food supply of the vegetable or animal, although the value of suitable food be not at all under-estimated. The planter who pays most attention to the Hygiene of his plantation, and at the same time attends well to the supply of suitable plant food, and to his pruning will most assuredly be repaid by larger and more constant crops.

Rule 1.—Train when young so that it will want little pruning when old.

Rule 2.—Never cut away large branches if it can be avoided.

Rule 3.—Always tar all wounds, or use other means to prevent the entrance of Fungi, by paint or varnish, etc. Chemical applications although useful at the time, do not last.

Rule 4.—In pruning always take out dying and all small useless *non* bearing wood from the centre of trees.

Rule 5.—Visit your trees frequently and examine their state of health, see what they require and give it them. Give your trees attention at short intervals.

A few rules for the pruner which should be learned by heart.

The Ground Nut.

The Ground-nut, Earth-nut, Pea-nut or Monkey-nut as it is variously termed, differs from all the other 'nuts' properly called in several ways. In the first place it is not really a nut but more correctly a pea or a bean, belonging to the same natural order of plants as all the rest of the peas and beans.

Secondly, it is the only pea or bean which is generally eaten by man in a raw or unprepared state.

Another peculiarity about it is that the nuts, contrary to the usual custom of fruits, which generally need the sun to ripen them, require to bury themselves in the soil in order to arrive at maturity. In fact not until the flowers which precede the fruits, are buried to a depth of 1 to 3 inches below the surface of the earth, do the fruits begin to swell.

Correa de Mello relates an experiment in which he interposed an object to prevent the flower-stalk from penetrating the soil; the stalk grew to a length of 4 to 5 inches in its attempt to get round the obstacle and finally it died without being able to form the pod.

As is the case with many cultivated plants which have been under cultivation for a long time, the plant is quite unknown in its wild state. All the other species of the genus Arachis to which it belongs are inhabitants of Tropical South America, so that there is every reason to believe that it originated in this country. It was known in Africa and Asia in the sixteenth century and now it is in cultivation throughout the tropics as well as in certain temperate regions.

Description.

It is a small clover-like plant seldom reaching a height of more than 20 inches. The stems mostly lie more or less prostrate on the surface of the soil. The leaves consist of two pairs of leaflets of an oval shape, which at night-time are folded together. The flowers which are pea-like and of a bright, orange-yellow colour are produced one at a time from large buds at the bases of the leaves. They usually wither on the same day that they are produced.

When the flower first appears it has no stalk: this commences to grow and elongate only after fertilisation has taken place. The flower-stalk continues its growth and turning downwards towards the earth buries the remains of the flower in the soil

The fruit then commences to swell and in a few weeks' time ripens into the pod containing the nuts.

Each pod usually contains two nuts, but one or three are not uncommonly found, and in a variety which is grown in Costa Rica, three, four or five may occur.

VARIETIES OF GROUND-NUTS.

The effect of cultivation on the ground-nut has been to produce a large number of varieties, more or less adapted to various conditions of soil or climate. Some varieties are especially suited to low and damp soils, others to lands which are higher and drier, others again are of rapid growth and hence suitable for cultivation in regions with a somewhat short, hot and dry season.

Roughly, the many different forms may be classified into "bunched" and running varieties. In the former the stems grow erect, while in the latter they run along close to the ground, but ascend at their tips. The kind commonly grown in Virginia furnishes a good example of the running forms; its spreading branches grow to a length of two feet or even more and pods are borne on them almost to the tip. The "Spanish pea-nut" is an instance of the bunched type, with several erect stems and the pods crowded at the base; this latter circumstance is due to the upper flowers being unable to reach the soil and form nuts. The "Spanish pea-nut" grown in the United States, is a variety which is popular both for forage, and for confectioners' purposes on account of the sweetness of its seeds.

The Virginia is another kind which is much in demand because of the small qnantity of oil contained in its seeds.

CULTIVATION.

The lighter sandy soils provided that they are not too dry, are the most suitable for growing pea-nuts. The plant grows vigorously in stiff clayey soils, but the yield of nuts is poor, because unless the soil has been well broken up, the tips of the flower-stalks are unable to penetrate into it to ripen the nuts. Another disadvantage of clay soils is that they stain the outside of the pods, thereby diminishing their value, except for local use.

To obtain the best returns, the soil must be reduced to a fine tilth to a depth of 4 to 6 inches. It is considered inadvisable to break up the soil deeper, because if the nuts are able to penetrate lower, the difficulty of gathering them is increased.

Before sowing, the nuts are removed from the pods and if not quite fresh, a few of them should be first tested on a small plot to ascertain what proportion of them will grow. If the shelled nuts have to be kept for some time before they are sown, they should be stored in small bags or baskets to prevent them from heating and losing all power of germination.

A bushel to a bushel and-a-half of pods (i.e. 24 to 36 lbs.) give enough seed to sow an acre of land. In Virginia the seeds are sown on ridges 2½ to 3 feet apart. The distance apart of the ridges appears to depend on the quality of the land, thus after a few crops of ground-nuts have been raised on the same land, the growth becomes less vigorous and the plants in the rows may hardly meet and cover the intervening spaces at a distance of 2½ feet apart.

The seeds are planted singly at distances of 1 to 2 feet apart along the ridges and at a depth of not more than 2 inches below the surface; and afterwards they are covered over with soil. In 7 to 10 days after planting, the young plants appear above the surface and fresh seeds must be planted to fill up gaps caused by any which have failed to grow.

The land requires weeding at intervals and breaking up with a hoe. When the first pods begin to form, the soil should be drawn up round the plants to help the pods to bury themselves.

Sometimes the nuts are planted on the flat instead of on ridges, the relative advantage of the two systems of planting depending chiefly on the depth of the soil and on the amount of moisture which it contains.

The crop matures in about six months after the seeds are sown, but the length of time required for ripening depends upon the variety grown and upon the climate.

Under favourable conditions and with varieties which ripen within the six months, two crops may be obtained in the year. The fact that the nuts have arrived at maturity and are ready for harvesting is shown by the leaves and stems of the plants becoming yellow and beginning to wither.

The crop is gathered in dry weather, by simply pulling up the plants by hand after loosening the soil around them. The vines are shaken free of earth and left for a day or two to wither; they should be sheltered in some way, if there is any likelihood of rain falling. When dry, the pods are picked off the vines and graded and cleaned for the market. Heavy rain at the time of harvest will cause the seeds to germinate in the pods and thus do great damage to the crop.

YIELD.

The size of the crop varies considerably according to the amount of care and intelligence given to the cultivation. Also the crop is a very exhaustive one and with successive sowings on the same land the yield falls off very quickly.

Thus in Virginia, where formerly the yield stood at 50—75 bushels of pods (equivalent to 1,200—1,800 lbs.) per acre, the average has now fallen to not over 20 bushels (= 480 lbs.) per acre. This great falling off in the yield is due to planting the nuts each year on the same land, removing at each crop all the vegetation from the land, for the dried plants are used as hay, and the failure to replenish the soil by means of suitable fertilizers.

As a rule in the tropics, on irrigated lands especially, the returns are far greater than in the United States, but the yields vary so considerably under different circumstances, that it is impossible to give any figures to show what may be expected in this colony.

USES.

Chief and foremost amongst the uses to which ground-nuts are put is the expression of the oil which they contain, Analyses show that generally as much as 40—50 per cent of the nut consists of oil.

"The oil, which closely resembles olive oil, replaces it largely in Europe and is used as a salad oil, also in soap-making, burning, dyeing, tanning and cloth-cleaning. It enters in the composition of salves such as cold-cream, pomades, etc. It is of some use as a lubricating oil and it forms a very important ingredient in the manufacture of oleomargarine. It also forms an adulterant of olive and almond oils..................of "ghi" or clarified butter (in India) and is recognised as officinal in the Indian Pharmacopœia, replacing olive oil." So that there are few oils in commerce which can be put to a more extensive use. In most of the countries where ground-nuts are grown, a portion of the produce is always converted into oil for local use.

The nuts are also used very extensively for food, when unripe they are often cooked and eaten and have then the flavour of kidney beams. The ripe seeds are too oily to be more than an adjunct to other food. Analyses of the nuts show that in addition to the large percentage of oil in their composition they contain usually from 25 to 30 per cent. of proteids and from 10 to 15 per cent. of carbohydrates (starch, sugar, etc.), which prove that they must be highly nutritious, in fact, they are said to contain three times the percentage of nutriment that beef possesses.

In the Eastern United States they are roasted in the shell and sold in large quantities in the streets of cities and towns. In Europe they have been used for adulterating coffee, cacao and spices. Sweetmeats are made from them to a small extent and in the United States a substance is sold as "pea-nut butter" which is made by grinding the seeds finely after they have been roasted.

After the oil has been expressed by mills in Europe the residue or "cake" left forms a valuable animal food and some use of it has been made for human beings.

Lastly, as the plant belongs to the Leguminosae and consequently its roots are provided with nodules which are able by means of the bacteria which they contain to take out the nitrogen from the air and so enrich the soil in which the plant is grown, it forms a valuable green-crop manure. Its close prostrate habit of growth enables it to quickly cover the ground and prevent the growth of weeds and thus renders it a very suitable plant for cultivating as an inter-crop amongst other and permanent crops, such as cacao, rubber and coconuts.

A. W. B.

Hints for School Gardens.

We have received from the Imperial Department of Agriculture for the West Indies a copy of a useful little work entitled "Hints for School Gardens," by A. H. Kirby, B.A., Agricultural and Science Master, Antigua, which is published as No. 48 of the well known Pamphlet Series.

In the Introduction the writer points out that the real purpose of instruction in the school garden is not merely for the purpose of showing how to grow vegetables, although this knowledge is gained incidentally "but it derives its value from its usefulness in training the intellectual faculties, especially those of observation and correct inference and its power to do this is the best indication of its real worth."

Throughout the work the writer appears to always keep the above object in view.

He also advises that "pupils should be put through a good course of box and pot culture and should thoroughly master the principles underlying it before they are allowed to proceed to the cultivation of plants in pots." This advice seems excellent and as only a small outlay is required in box and pot culture, this form of object lesson might well be adopted in all schools, not only as preparatory to work in a school garden when the school possesses one, but also in those schools which at present are unable to afford the initial expenditure in establishing one.

The first part is taken up with clear and concise instructions for carrying out the different operations in raising and subsequently caring for plants grown in pots and boxes. The rule given for performing each operation in this method of cultivation are followed by a brief explanation giving the reasons why the instructions must be carefully carried out if success is to be attained.

These short and clearly-worded explanations are in every way admirable and will serve to give the pupil a good acquaintance with the requirements of plants in general. In fact the whole of this part forms an excellent introduction to the chief facts of plant physiology. The boy who has gained some knowledge of the way in which plants live, what they feed upon and how and under what conditions this food is absorbed has, apart from its educational value, already gained a sound grounding in the first principles of agriculture which cannot fail to be of great practical benefit to him later.

Then follows a course of Preliminary Lessons for the commencement of plot work, which includes instruction in the formation of a school garden from the very beginning. The pupils are taught in the different lessons how to prepare and mark out the ground, to plant hedges and to make up the plots and beds. The raising of seedlings for planting in the plots is assumed to have been learnt already in the lessons on pot and box cultivation.

The third section of the pamphlet is occupied with special instructions for growing all of the ordinary vegetables and economic plants, other than trees or shrubs. Here again it will be almost impossible to improve on the short, simple and precise directions given for each kind of plant, which include the distances apart and methods of planting and subsequent treatment, as well as the time usually taken for the crop to arrive at maturity and the kind of soil which has been found to be the most suitable. A chapter on the various methods of Budding, Grafting and Pruning written in the same clear style closes the work.

The pamphlet can be thoroughly reccommended for its general arrangement, clearness and practical utility and we have no hesitation in pronouncing this work to be the best that we have met with, dealing with this subject. It should be in the hands of every schoolmaster who has anything to do with a School Garden. It is obtainable at *The Daily Chronicle* Office and the low price of 4d. at which it is published will place it within the reach of almost anyone.

A. W. B.

Effects of Pruning on Fruit Trees.

The horiculturalist and the farmer are very much inclined to carry out all of their work in raising crops by rule-of-thumb methods. The only reason they would be able to give for many cultural operations which they regularly and systematically perform year after year, is that they are following the customs of their fathers and grand-fathers.

Some of these methods established by long usage, though purely empirical have been found when investigated, to be capable of scientific explanation and their efficacy has been proved. Others on the contrary have been shown to be of no real value, or even disadvantageous and have survived for a long time only because it has occurred to no one previously to test their utility and to carry out a careful set of experiments with this object in view.

To the latter category appears to belong the pruning of fruit-trees, the performance of which at regular periods according to certain rules, has been held and taught as a necessary practice by generations of fruit-growers from time immemorial.

A series of experiments with the object of determining the effects of pruning on fruit trees have been carried out on scientific lines for the last twelve years on the Woburn Experimental Fruit Farm by the Duke of Bedford and Mr. Spencer Pickering, F.R.S., and the latest results and conclusions are contained in the seventh report recently issued. An excellent summary of the report was given in "Nature" for the 11th April, 1907, on which I am dependent for this account.

First of all it should be remembered that the conclusions arrived at in this report are based on experimental evidence and are therefore, of course, of far greater value than mere expressions of opinion; and though they apply only to particular trees on a particular soil, they suggest that the ways of a practical gardener are not always the best.

It has always been an axiom with most practical fruit-growers that "growth follows the knife," "but by measuring and weighing trees it has been found that the less a fruit tree is pruned the larger and heavier it becomes even when allowance is made for the amount of wood removed in the annual pruning of the normal trees. The fruit-crops of trees are also increased as the amount of pruning is diminished, so it appears that the

less pruning done the better is the result both as regards growth and fruit."

A convenient summary of the results obtained is given at the end of the report. It was found that at the end of the twelve years' experiments the trees which had not been pruned at all were 20 per cent heavier than those which had been moderately pruned whilst those which had been hard pruned were 16 per cent lighter. The weight of the wood removed in pruning will not account for this difference, so that pruning not only does not increase the actual size of a tree, but it results in less new wood being formed.

The advantages of reduced pruning were seen best in the resulting increase in the crops. During the first five years the crops were more than twice as great from the unpruned trees as from the moderately pruned ones and more than three times as great as from the hard pruned ones. In the succeeding five years and in the twelfth year the differences were still greater in favour of the unpruned trees.

Pruning made no appreciable difference in the size of the fruits, but only in the number borne by each tree.

All the above results refer to healthy trees, but in the case of a tree which has become stunted or has had its growth checked by some injury to the roots, as, for instance, when it has been transplanted, hard pruning back is recommended to prevent precocious fruiting, which would generally result in the tree becoming permanently stunted. The cutting back of a freshly planted tree must be done before growth begins.

" Apart from the cutting back of freshly planted trees, the present results are emphatic in showing that the less pruning is done the better. But this does not imply at all that no pruning should be done. The removal of branches which cross or rub against each other, as well as that of any unripened wood, is evidently desirable, and no doubt a certain amount of pruning, in order to obtain a compact and shapely tree, should be done during the first few years after planting. But a tree which is growing freely, and is properly tended in other respects, will require very little pruning to keep it in shape."

A. W. B.

Solanum Commersoni Violet.

One reads almost daily in the local papers, articles on what Rubber is going to do for the Colony and what the Brussels Convention is going to do to Sugar.

How many people look at the shipping column and note under the heading 'entered', the many articles of food brought in here day after day, many of which we should rather be exporting.

Prominent amongst these are the number of crates and sacks of potatoes, and turning to the Blue Book of the Colony we find that just upon $100,000 leaves our shores annually for this staple article of food; surely our farmers could retain some at least of this huge sum.

It is said that English potatoes will not grow here, but the potato under consideration in this article might well be expected to take its place.

Solanum Commersoni Violet is originally a native of tropical South America, growing in moist soils generally by the side of rivers; in many respects it resembles the common potato (Solanum tuberosum). The credit of deriving a cultivated potato from the wild tuber is due to a Frenchman Mons Habergine who has been carrying out extensive experiments with various varieties for several years.

Though it differs slightly from the true potato in being more pointed in form, in frequently possessing aerial tubers and in having a slightly bluish-red appearance before cooking, from which it derives its name 'violet', it is all that can be desired for household use, indeed as will be shown later, it has somewhat the advantage over the ordinary potato in food value.

Experiments have shown that the yield per acre is from 21,500 lbs.—34,700 lbs. giving best returns in moist soil; in very moist soil it has given 4½—15 lbs weight in tubers from a single plant.

As stated above the plant does best in a moist or even marshy soil, where it gives a maximum yield, but in comparatively dry soils good yields are obtained, its yield being from 30—100% greater than the common potato. The tubers are rich in starch being in this respect superior to the common potato thus asserting its right to a high place amongst our edible plants, added to this the "Violet" has so far, proved itself impervious to the attacks of the potato disease (Phytophora infestans) and is now being

cultivated largely in those parts of Ireland which have suffered most heavily from potato disease. The fact that the Violet has frost enduring powers enabling it to be grown in Great Britain has no interest fortunately, in this favored climate and need not here be gone into.

The Violet has been on the market for some years principally in the British Colonies and on the Continent and there is every reason to expect that it would meet with a most encouraging reception if placed upon our local market.

The price in England now is about $19 20 per ton and taking the lowest experimental yield viz., 10¾ tons it will be readily seen that the return is very considerable amounting to $206 40 per acre per crop.

Finally to summarise; an endeavor by our farmers to give this remunerative crop a trial may be advocated principally for the following reasons.

(1). It grows to perfection in moist soils such as those of British Guiana.

(2). It is a most prolific cropper.

(3). So far as known at present it is immune from disease.

(4). (Last but *not* least). The market is here to-day calling for supplies, and failing to obtain them from the farmers taking thousands of dollars out of the country year after year.

W. M. SMYTH.

Hints on the Preparation, Packing and Transmission of Specimens to the Government Botanist's Office.

Plant Diseases and Insect Pests.

1. All examples of these should be accompanied by as full information as can be supplied as to the nature and extent of the damage done, the prevalence of the disease, when it was first noticed, etc.

2. When the injury appears to be due to the attacks of a fungus, it will be advisable to send specimens of the parts attacked in a small vial of rum or other spirit for microscopical examination.

3. When, on examination an insect appears to be doing the damage, specimens of the insect in its different stages should be collected and sent.

4. If the insects are sent alive some of the plant on which they are found feeding must be enclosed with them to keep them alive on the journey and to afford them a foot-hold. The box should also have some small holes pierced in it to admit fresh air for breathing.

5. Hard-bodied insects, such as beetles, grasshoppers, etc., may be killed before sending by immersing them for not longer than half an minute in boiling water. They are then allowed to dry and should be sent packed in sawdust or dry grass so that they cannot shake about on the way.

6. Soft-bodied insects, and other pests, such as worms, grubs, plant-lice, flies, etc. should be sent preserved in rum or any other spirit. The spirit should not be too strong or it will make the specimens too hard and brittle for examination. Ordinary rum diluted with twice the quantity of water will be of a suitable strength.

7. Butterflies and moths must be killed before sending by squeezing the body sharply below the insertion of the wings. The wings are then to be folded back to back and each specimen placed in a paper envelope and packed in a box so that it cannot shake about on the journey.

8. All specimens sent through the post should be carefully packed in an empty tin or a wooden box sufficiently strong for the purpose and which is not likely to get crushed on the way.

Specimens of Plants for Identification.

1. These should be pressed out flat and dried before they are sent, especially if they are likely to be for some length of time on the journey.

2. To press and dry the plants they are placed between several thickness of old newspaper or other paper and a heavy weight of some kind such as a box or a canister placed on top. A better way is to place them between two pieces of board and to put heavy weights such as stones or pieces of rock on the top board.

3. The specimens should be changed at least every alternate day into dry sheets of paper, until they feel quite dry. The drying of the specimens may be hastened considerably and the attacks of mildew prevented, if the paper is made thoroughly warm and dry before putting the specimens into it.

4. It is important that the specimens sent shall have both flowers and leaves and if they can be obtained the fruit and seeds as well. All plants, including trees, are chiefly classified by means of their flowers and it is usually impossible to identify them with certainty or often to name them at all when only the leaves and bark are sent.

5. More than one specimen should be sent, in case it may be necessary to forward some of them to Kew for identification.

6. It is desirable to attach the local or Indian name to the specimen when one is known and information as to any special use to which any part of the plant is put is always of great interest.

7. The specimens should be forwarded as soon as possibie after they are dried as they are very liable to the attacks of insects and mildew. Mildew may be killed and prevented from spreading by touching the parts attacked with rum or with other spirit. The plants should be carefully packed for transmission and protected by a piece of stout cardboard or thin wood to prevent them from being damaged in the post.

8. Dried specimens of the flowers and leaves, and fruit, if possible, are particularly desired of timber trees as the correct botanical names of most of these have not yet been determined.

Economic Products.

1. These include rubber, gums, fruits, tubers, seeds, barks, etc., and some of them will require special packing if they are likely to be some length of time on the journey.

2. When the articles are dry or drying will not injure them, they should be dried before being sent, as if packed while damp in a close package they are very liable to be ruined by mildew on the journey.

3. When it can be easily obtained, sufficient of the product should be sent to allow of its being thoroughly examined and tested and, if necessary, submitted to chemical analysis.

4. As full information as possible should at the same time be forwarded as to the habits, abundance or scarcity, local name when known, etc., of the plant from which the product has been obtained. Dried specimens of the plant, prepared as described elsewhere should also be sent for the purposes of correct identification.

5. It is very probable that many valuable economic products, in addition to those already known and regularly collected, can be obtained from some of the great variety of trees occurring in the large forests of British Guiana. The help and co-operation of those whose employment takes them into the forest is earnestly requested in endeavouring to ascertain more completely the forest resources.

All specimens should be addressed to the Government Botanist, Botanic Gardens, Georgetown.

A. W. BARTLETT.

Buxton and Friendship Agricultural Show.

The fourth biennial Agricultural, Live Stock and Industrial Show of the Buxton and Friendship Farming Association was held in the Wesleyan School-room at Friendship on Tuesday, 20th August. His Excellency the Governor, Sir F. M. Hodgson, K.C.M.G., performed the opening ceremony.

The Show, taken as a whole, showed little, if any improvement on its predecessor. The almost continuous wet weather experienced during the first six months of the year was probably largely responsible for the generally poor quality of the *fruit* exhibits. A noticeable feature in much of the fruit shown being its want of flavour. The best entries in this section were the *coconuts* and the four exhibits which were adjudged to be the best were of exceptionally fine size with a good thickness of kernel.

The *vegetables* were generally of very fair quality, some of these which obtained prizes being decidedly good. No less than six of the prizes were obtained by various school gardens, in competition with the farmers, the exhibits from the Belfield Model School Garden being awarded three out of the six.

The tannias, sweet cassava, bread-fruit, squashes and boulangers were amongst the best of the exhibits.

In the section for *Economic Products*, the rices though very few in number were mostly of good quality. The meals and starches left little to be desired, being of such uniformly good colour and so well prepared that judging was in some cases a difficult matter.

In the classes for honey, pickles, hot sauce, jellies and preserves, ordinary care had not been shown in many cases in preparing and putting them up. In too many instances the corks or stoppers used in the bottles or jars were dirty and discoloured, to which were probably due the signs of fermentation observable in some of the preparations containing sugar. Besides the use of old and dirty corks and stained labels is sufficient to make one doubt the observance of proper cleanliness in the preparation of the contents of the bottles.

Some of the jellies had more flavour of sugar than of the fruit of which they were supposed to be compounded. The liquid condition of many of the preserves and jellies would be fatal to heir keeping qualities, especially in a tropical climate.

The specimens both of coconut and castor oil, though poor in numbers, were beautifully clear and bright, of good colour and with the characteristic odour and taste.

Special prizes were offered for tapioca and bread-fruit flour and some good samples of these, well worthy of the prizes, were exhibited.

Of tapioca, cassava and arrow-root starches, ground-nuts, coconut and castor oils, one would like to see more abundant exhibits. Those shown were sufficient to prove that these articles can be produced locally of excellent quality. They will all keep well, for all of these products there is a large commercial demand and if produced in fair quantities they could be profitably exported.

The exhibits in the *Live Stock* section were poor both in numbers and in quality.

As at previous shows the *Board of Agriculture Exhibit* occupied a prominent position and made a very attractive show illustrating most of the various actual and possible agricultural industries of the colony and showing also the way in which articles should be put up for exhibition. The exhibit included economic plants, fruits, fibres, seedling canes, cottons, rice etc. Good samples of cocoa beans, kola nuts, fruits, honey, bees-wax, etc, from the Onderneeming Industrial School were shown. The Board of Agriculture collection of prepared fibres and fresh specimens of the plants from which they had been obtained was an interesting feature.

Samples of coir rope made by the inmates of the Alms House and a large roll of excellent coconut fibre matting manufactured at the Georgetown prison illustrated how the husks of coconuts which are invariably thrown away, might be profitably utilised.

A. W. B.

Board of Agriculture.

A meeting of the Board of Agriculture was held in the Court of Policy hall at 2 p.m. on Monday, 26th August. His Excellency the Governor presided. The other members present were Professor J. B. Harrison, C.M.G., Hon. R. G. Duncan, Rev. F. C. Glasgow, Messrs. E. A. V. Abraham, F. Fowler, J. Monkhouse, W. M. Payne, A. W. Bartlett and Dr. Egan. A letter from Hon. B. Howell Jones was read, expressing regret at his inability to be present.

The following were some of the principal matters considered:—

The Prize List of the recent Agricultural Show at Buxton was submitted. His Excellency said that he thought the Show, at which he had been present, showed little or no improvement on that of two years ago, which he also attended. He considered that probably the unfavourable weather experienced had been against the cultivators.

Mr. Duncan suggested that the Agricultural Instructors, when visiting the cultivations, might report on the condition of them and whether they had improved or the reverse. His Excellency expressed his approval of this being done.

Referring to the report of the Board of Agriculture for 1906-7, Professor Harrison said it showed that during the year the area of rice under cultivation was 26,567 acres, the yield being 3,152 tons. This was about 2,600 more acres than last year and showed a steady advance as regards area.

His Excellency intimated the receipt of a communication from the Secretary of State for the Colonies acknowledging the resolution passed by the Board on the 8th April last with regard to the Brussels Sugar Convention, in which it was stated that the matter was receiving the careful attention of His Majesty's Government.

A report by Mr. Mansfield, Agricultural Instructor, on a visit to Pln. Christianburg was submitted. Professor Harrison said that the report referred to a few experiments in tree-planting which had been started at Christianburg, 11 months ago. The report showed that, except for one tree, Teak had not done well, the plants being attacked by 'cushie' ants. Mahogany had done fairly well both on the low land and on a small hill. The Central American Rubber (Castilloa elastica) had made poor growth and the Funtumia elastica had been disappointing. Ceara Rubber (Manihot Glaziovii) had made very satisfactory growth in both places.

All of the Para Rubber (Hevea brasiliensis) were making excellent growth and had not suffered from the attacks of insects. It had done rather better in the low land than in the higher.

Professor Harrison spoke in favour of a rubber experiment station at Christianburg, as there were large areas of land locked up and doing nothing on the Demerara River.

A report of the Government on the results of inquiries made as to the possibility of establishing a banana export trade, was laid on the table. His Excellency stated that the results of the inquiries were not satisfactory.

Mr. Duncan said that he had gone into the matter very carefully and the want of a reliable labour supply was the difficulty. Any person who wished to take up banana cultivation risked being left if he depended on the labourers.

Professor Harrison said that the late Mr. Jenman maintained that we could grow bananas as well as any place and that the colony was particularly adapted for the industry.

Professor Harrison mentioned the receipt of a very useful pamphlet "Hints on School Gardens" which he thought the Board should recommend to be supplied to the schools for the instruction of the teachers.

Mr. Payne moved the following motion:—

"Whereas it is expedient that better facilities should be afforded to farmers and others for the purchase of economic plants.

Be it resolved that this Board recommends that a stall be opened in the Stabroek Market for the purpose of supplying such economic plants as may be suitable for farmers and that the Mayor and Town Council be approached with the view of obtaining such stall free of rent."

Mr. Payne spoke in favour of his motion. His Excellency approved of the motion and appointed a committee to deal with the matter.

The question of representation at the Agricultural Conference to be held at Jamaica in January was considered. It was decided that Professor Harrison, the Hon. B. Howell Jones and one of the education officers should be asked to represent the colony.

Professor Harrison announced the arrival in the colony of the bull, the boar and two rams ordered from Canada. He said

that the Government Veterinary Surgeon had reported them to be of high quality.

Regulations for the Control of Live Stock at Onderneeming Farm were read and passed after amendment. Professor Harrison reported that the stock had increased very largely and said that some of the animals would have to be got rid of by sale.

It was announced that the Board would meet at 3.30 p.m. on Monday, 2nd September, in the Entrance Office of the Botanic Gardens for the purpose of inspecting the plants, live stock, etc.

The meeting then adjourned.

A. W. B.

DISTRICTS ASSIGNED TO AGRICULTURAL OFFICERS.

The Director of the Department of Science and Agriculture has assigned the following Officers of the Department to the districts opposite to their names:—

MR. J. E. BECKETT, Berbice.

MR. A. L. MANSFIELD, West Demerara.

MR. J. D. GARDNER, North West District.

MR. J. P. GRAY, East Demerara.

MR. W. R. KING, Essequebo.

Officers will make themselves acquainted with the Agricultural conditions in their districts so as to be able to report on the development of agriculture in them.

Farmers and others desiring visits to their cultivations from the Agricultural Officers should apply to The Government Botanist, Botanic Gardens, Georgetown.

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Lagos Silk Rubber (Funtumia elastica.)

Having received several inquiries about this tree and abundance of the plants being usually obtainable at the Botanic Gardens and Onderneeming School, it was thought that an account of the cultivation, preparation, and the value of this variety of rubber might be of use. For many of the following notes I am indebted to an article "Notes on Rubber-producing Plants" by W. Harris, F. L. S., which appeared in the Bulletin of the Department of Agriculture, Jamaica, for November, 1906.

OCCURRENCE, ETC.

The Silk-rubber tree known locally as "Iré" occurs widely distributed in West Africa from Sierra Leone to the delta of the Niger, also in the island of Fernando Po and French Congo. More recently it has been found also in the forests of Uganda. The plant is specially cultivated in the Congo Free State and the Cameroons; in the latter country there were said to be, in 1905, about 350,000 of these rubber trees planted, one plantation alone possessing 100,000.

The trees grow rapidly in this district as both the climate and the soil are suitable and the Funtumia is free from the few diseases which attack other varieties of rubber.

PROPAGATION.

The plants are generally grown from seed although there is little difficulty in rooting cuttings. The seeds have this great advantage over those of Para Rubber and Castilloa elastica that they will keep good for six weeks without special precautions being taken to preserve them and will even germinate after three months.

The fresh seed will grow in about 15 days after sowing. The plan followed in raising these plants in the Nursery of the Botanic Gardens is to germinate the seed in boxes of light soil, covering the seeds with a very thin layer of soil and when the plants reach a height of about 3 inches to transplant each one separately into a basket or a pot. The plants are found to be very hardy and few of them die. The same hardiness is observable in Funtumia plants which have remained for a long time in the Nursery without repotting, as a consequence of which the roots have become very badly pot-bound, sometimes almost entirely filling the pots.

Although as may be expected this has interfered very much with their growth, the plants remain to all appearance perfectly healthy and the leaves keep their dark green colour. Nor have I observed any insect pests or fungus diseases attacking the plants.

Planting Out.

From experiments made in the Cameroons planting at a distance apart of 6 metres (= 20 feet) is recommended for Funtumias. The plants are said to grow not so well in the shade as in full sun ; " when they are too weak to resist the drying action of sun and wind they naturally should be protected, but when they are strong enough to resist this they develop better when fully exposed to the sun provided that the ground is damp enough." For this reason the plan frequently followed of planting Funtumias in lightly cleared forest is not recommended.

From what I have observed the Funtumia appears to require better drained land for its successful growth than is necessary for either Para Rubber or Sapium Jenmani which are usually found growing in somewhat swampy ground.

The Funtumia is not particular as to soil, it grows equally well in lateritic or basaltic soils, rich in humus or stony.

One peculiarity about the Funtumia is that in spite of the large size of the full-grown trees, the young trees begin to bear seeds when they are two and a half years old.

Pruning.

Both in the West Indies and in British Guiana " it is noticed that the young trees if left to themselves are liable to assume a bushy habit and are thus rendered less valuable for rubber yielding qualities. To correct this it is recommended that the trees be pruned by gradually taking off all the lower branches

and that one central clean stem be encouraged. In Lagos the tree attains a height of 90 to 100 feet before branching which makes it easy for the collector to tap the trunk."

COLLECTING AND PREPARING THE RUBBER.

It has been found in the Cameroons that Funtumia elastica yields commercial rubber at five and a half years. Although the quality is not of the very best at this age, yet it is a useful rubber. The most productive method of tapping was found to be a double herring-bone of fifteen cuts on each side. This produced 2½ oz. of rubber in one day. It would pay with labour at 9d. per day to tap trees of this age, but would perhaps injure the trees.

In the Agricultural News, Vol. VI., No. 127, p. 77, appeared an account by the Hon H. Hesketh Bell, C.M.G., of the method of tapping and preparing the rubber collected from the native Funtumia elastica trees in Uganda. Herring-bone incisions which reach up to the height of 40 to 50 feet are made on one side of the tree with a V-shaped tapping tool.

The trees are tapped every three months so that in each year every side of the tree has been made to yield its milk. Each tree yields on an average about one quart of milk at each tapping and each stem may be expected to give about 1 lb. of pure rubber per annum.

The milk is at once brought to the factory and is allowed to stand for a couple of days in large earthenware pots; it is then strained through pieces of red cotton known as "Turkey red" to remove impurities and mixed with an equal quantity of water. A pint of the mixture is then put into a small earthenware pot which is placed in a larger vessel of water kept at a temperature just below boiling-point. One per cent. of carbonate of potash is added to the mixture of latex and water and the mixture stirred with a wooden spoon until it coagulates, which usually takes place in 3 or 4 minutes. The use of the carbonate of potash is to prevent the rubber from turning to a dark colour. When the latex has coagulated the lump of rubber is taken out of the pot and placed under a press resembling a copying-press worked by two men, which squeezes out all the moisture and transforms the rubber into the shape of a very thin pancake of a creamy white colour. This process extracts nearly all of the resin as well as the water. The pancakes are then thoroughly washed in water and placed to dry in the shade, on shelves made of reeds. The rubber becomes a dark amber colour but is quite clear and transparent.

Mr. Hesketh Bell adds that "the produce of the Funtumia obtained by the process above described is now selling in London at 5s. 6d. per lb., a price almost equalling that obtained by the best Para."

The largest trees of Funtumia that I have seen growing in this colony are some planted on a high and well-drained estate's dam, amongst plantains, at Pln. Hope. The plants were obtained from the Botanic Gardens at the beginning of 1904, and when I last saw them early in 1907, several of them had reached a height of over 20 feet and were fruiting. The girth of the stems was proportionately thick, but unfortunately they had not been pruned to a single stem, as advised above, and were branching freely. When cut the latex flowed plentifully and a drop of it rubbed between the finger and thumb to hasten coagulation produced a small pellet of highly extensible rubber showing how rich the latex was in caoutchouc.

The following are some of the points in favour of planting the Funtumia elastica more extensively than has been been done hitherto :—

1. There are trees in the colony seeding freely and large numbers of the plants can be obtained at short notice without the necessity of waiting for supplies of seeds to be imported as is the case with the Para Rubber.
2. The tree has been found to be hardy, and to make excellent growth a short distance from the coast on well-drained land. As it will stand full exposure to the sun it appears to be very suitable for planting along estate dams.
3. The rubber produced by the Funtumia is of high quality and is now sold at a price very little below that of the best Para Rubber.

The Use of "Wild Rice" Grass in preventing Coast Erosion.

Along many parts of the sandy sea-coasts of England, Europe and the United States above the reach of the highest tides occur more or less extensive tracts of sand-hills or as they are frequently called 'dunes.' The sand is washed up by the waves and when it becomes dry is carried inland by the wind and accumulates to form irregular ridges or low hills. The sand generally forms a soil of too poor and shifting a nature for plants to establish themselves and the few that do succeed in growing for a time are sooner or later cut off or buried during winter storms.

Sand dunes of any extent are rare along the sea-coasts of warmer regions, both because the long growing season is more favourable to the growth of vegetation which fixes and soon covers up the sand, and because the winter storms are seldom so severe as in more northerly regions.

Often it happens that these sand dunes are gradually carried inland by the wind to encroach upon and overwhelm forests and fields, railroads and buildings. The serious loss caused by damage of this kind as well as the possibility of utilizing parts of these dunes when extensive for agricultural purposes, have led to experiments being made on a large scale with the object of endeavouring to establish certain plants which would be able to fix these shifting sand-hills.

Bulletin No. 57 of the Bureau of Plant Industry of the United States Department of Agriculture entitled "Methods used in Controlling and Reclaiming Sand Dunes" by A. S. Hitchcock, gives an interesting account of the work that has been done in this connection by the various Governments in Europe. In most cases the operations carried out are required to be on so extensive a scale and to be steadily pursued for a number of years, so that they are almost beyond the scope or the means of private individuals.

Various plants have been tried for binding the loose sand of dunes but none have been found to be so successful as certain grasses, especially one known as the "beach grass" or "lyme grass" (*Elymus arenarius, Linn.*) which occurs naturally growing on sand-dunes in Great Britain and North America.

In growing it, it has been found useless to sow the seeds upon the unprotected sand, so the method followed is to dig up and

transplant bunches or tufts of this grass in rows or squares, the direction of the rows being usually perpendicular to that of the prevailing wind. Under average conditions the rows are from 15 to 18 inches apart and the plants about one foot from each other in the rows. In certain places other methods of a mechanical nature are used for binding the sand.

After the drifting of the sand has been prevented by the "beach grass" or one of the other methods, the dunes are *permanently* fixed by planting them with trees to form forests which will in time become a source of revenue to the Government. Coniferous trees such as the Pine, Fir or Spruce are usually employed for this purpose.

A problem of a somewhat similar nature is presented when in the place of drifting sand carried by the wind, it is desired to bind shifting mud borne by the sea. For the benefit of those outside this colony a brief account of the coastal conditions will not be out of place.

The coast region of British Guiana consists of alluvial deposits derived from the silt brought down by the Amazon and carried along the coast by currents until it is finally deposited. By this means a tract of land has been formed from ten to thirty miles wide of exceptional fertility most of it below the level of the sea at spring tides. The raising of sea defences to keep out the sea and the empoldering and draining of the land were carried out by the Dutch settlers who were the first to develop the country, which in its physical features bore so close a resemblance to their own.

In certain places the land is being added to by deposits of mud brought in by the tides, which later become consolidated. In other places a "wash" may set in by the tides sweeping the mud away and encroaching upon the solid land, rendering necessary new dams and in same places very costly sea-defences to repel the encroachment of the ocean.

Within the reach of the high tides the coast is fringed by a narrow belt of trees, consisting almost exclusively of three species known, respectively, as Courida (*Avicennia nitida, Jacq.*) Black mangrove (*Rhizophora Mangle, Linn.*) and White Mangrove (*Laguncularia racemosa, Gaertn*). The Courida is generally the predominant species. These trees grow in the soft mud of the shore and at every high tide their roots are covered by the sea.

In April or May of the present year evidence was given before the Coast Erosion Committee by Lord Montagu of Beaulieu as

to the valuable protection afforded to the banks along Southampton Water by a grass which had established itself there and had increased rapidly within recent years. Reference was made to these statements at the time by various newspapers and as the result an inquiry was addressed to me by a firm owning several sugar estates in the colony as to whether the grass mentioned was obtainable in the colony or as to the occurrence of indigenous plants and grasses which would be likely to be of equal service in protecting the coast from erosion.

As the subject was of much importance it was brought before the Board of Agriculture and some valuable information was obtained. Many of the members were sugar planters and had practical experience in the upkeep of the sea-defences in front of their estates.

A question was addressed as to the value of the Courida in resisting coast erosion? It appeared to be the general opinion that Courida was very unsatisfactory. The roots do not penetrate deeply but feed for the most part on the surface and the consequence of this is that the full grown trees which often attain to a considerable height, are easily blown down by a strong wind and readily uprooted by a slight wash. The overthrown trees unless quickly removed are capable of doing much damage to the sea-defences when washed about by the waves.

On the other hand the Courida appears to be of some use in withstanding the encroachments of the sea when left undisturbed. The fact that it has managed to establish itself throughout the length of the coast and in most places to become the predominant species in the mangrove belt, proves that it is well adapted for the situation in which it grows. The old Dutch planters recognized its usefulness because I have been informed by a lawyer that " it was made part of the grant to the estates that the cutting of Courida from the foreshore cancelled the grant," so that although the Courida is considered to be far from satisfactory in preventing coast erosion, still there is sufficient evidence to show that it is of some assistance and hence should be protected until a better substitute can be found.

Substitutes for Courida.

The Mangrove on account of its abundant wide-spread and deeply-seated system of roots which enables the tree to withstand heavy seas and strong winds, was considered to be of much greater value than the Courida in protecting the foreshore against erosion. Of this tree I shall have more to say later.

John Junor, Esq., the manager of Pln. Vryheid's Lust, made mention of a grass known as "wild-rice" which has been of great saving to the foreshore of "Better Hope" and "New Montrose" estates, where he had been planting it for some years past. I took an early opportunity of visiting the place where the grass had been planted.

"Wild Rice."

For a length of about 100 rods this grass covers the higher and upper parts of the foreshore which it has largely helped to build up and there are large patches of it growing in various places in the soft mud on the lower parts of the shore, which are covered by the sea twice every day at high tide. Except for young mangrove trees planted in places of the shore which have been built up by the mud accumulated by this grass, it appears to be the only plant which is able to become established in the soft shifting mud on the seaward side of the fringe of Courida.

Mr. Junor noticed this grass many years ago growing on the banks of the Demerara River at both Vriesland and Providence plantations and observed how the soil accumulated around it which led him to test its powers in protecting the shore from erosion when he became manager of Pln. Vryheid's Lust. His experiments were entirely successful and after the grass had become established he tried planting mangrove trees amongst it, so that to-day there is a forest of these trees springing up and requiring no further attention.

The grass appears to be identical with specimens of *Spartina brasiliensis*, *Raddi.* in the herbarium of the Botanic Gardens. The plant grows to a height of 2½ to 3 feet, its stems and leaves are stiff and wiry, the lowermost leaves being almost spiny. The flowers are produced in close-branched panicles, bearing some resemblance to the early flowering stage of the rice plant, which I suppose together with its gregarious habit of growth on muddy banks has earned for it the local name of "wild rice." The upright stems spring in tufts provided at the base with an abundant supply of fibrous roots which penetrate deeply into the mud. From the base of each plant is given off a number of white suckers which spread under the surface of the mud forming at the nodes fresh tufts of stems and roots.

Method of Planting.

Mr. Junor informs me that he plants the tufts of the grass in rows, the rows being six feet apart and the plants in the rows

separated by a distance of two feet. The depth at which the tufts are planted is about one foot below the surface. The grass spreads quickly so that in a short time the plants meet forming a patch, the numerous stems of which serve to fix the mud and prevent it from being washed away by the sea. Even should the mud cover up the plants after they have been planted, they are able to make their way through it in time.

THE MANGROVE.

When the grass is firmly established Mr. Junor's plan is to plant the seedlings of the mangrove in amongst it. Anyone who is at all observant can scarcely fail to have noticed that when the seeds of this tree are ripe instead of falling to the ground they germinate on the parent tree from which they draw nourishment to enable them to grow and they put out a long pointed club-shaped shoot directed downwards, which is not the root but known under the botanical name of *hypocotyl.* When the seedling is sufficiently advanced it falls off the tree and the hypocotyl penetrates into the mud by means of its pointed end from which it soon puts out roots. The upper end of the seedling which bears the bud grows out to form the stem of the tree. There follows then a great development of roots both from the trunk and the branches, which, after the manner of flying buttresses, firmly support the tree in the soft mud and enable it to withstand the strongest breezes and the heaviest seas. These ærial roots being more or less curved allow a certain amount of "give" or play which is often of advantage in enabling a structure to withstand pressure without collapsing.

So the mangrove tree is in many ways particularly adapted for growing along muddy sea-coasts, which are exposed to winds and waves. The young plants grow rapidly and in a few years will themselves produce a crop of seedlings. The club-shaped seedlings are obtainable in abundance along the coast and should be gathered for planting when they are nearly ready to fall. All the planting that is required is merely to insert the lower pointed end of the seedling in the mud.

When the mangrove trees have grown to a fair size they form a close shade and so far as my observation goes they kill out the "wild rice" which appears to require full exposure to the sun's rays, for at least a part of the day time, for its successful growth. But by the time that the mangrove trees have reached a sufficiently large size to do this, they will themselves have taken over the function of the "wild rice" in preventing coast erosion and hence the latter is no longer required.

Other Mud-Binding Grasses.

In the Kew Bulletin of Miscellaneous Information No. 5., 1907, there is an article on "Mud-binding Grasses" in which a description is given of the grass growing along Southampton Water which I have mentioned above. It is interesting to learn from this article that the grass referred to is a very close relative of the so-called "wild rice" of this colony, being another species of Spartina (*Spartina stricta, Linn.* and allied forms). Also it is known locally as "rice grass" and "sea rice" although no explanation can be given for the origin of these names. As the climate of England is too cold for the cultivation of rice, very few of the dwellers in the neighbourhood of Southampton Water can at any time in their lives have seen rice growing and so have been able to notice the resemblance between it and the wild grass.

The plant is said to have been introduced by a ship from the River Plate coming up Southampton Water some years ago with a quantity of the grass on board (for what use the article does not state), the seeds of which became distributed along the shores of Southampton Water with the result that the whole of that estuary is now covered by the grass. Lord Montagu of Beaulieu who reported this fact in giving evidence before the Royal Commission on Coast Erosion stated that as the result of this introduction "the mud banks on his property had recently been increasing very rapidly." Further he said that "He could not help thinking that the grass would be a most valuable addition to the means of reclaiming mud and sand flats near the mouths of rivers. He did not know that it would act in very exposed places but he had noticed in the Solent when there was a considerable sea on and where the grass grew down to the water's edge, that when big waves came it seemed to withstand their action very much better than where the mud existed without grass."

It would be premature to suppose because one experiment has so far proved successful, that the troublesome problem of preventing coast erosion has been solved, but I think Mr. Junor's method is likely to be of great utility and importance in this colony.

It is based on the same principles as the methods employed in controlling sand dunes already described, which consists in the preliminary binding of the sand by means of grasses and after this has been accomplished the permanent fixation by planting trees.

For the possibilities of the method to be fully determined further experiments require to be tried in planting the grass in various places along the sea-coast, especially where the land instead of "making" is being washed away because if it is found that the grass is able to establish itself almost anywhere, it is more particularly in these localities where it will prove of the greatest service.

When the grass is found to be growing successfully the planting of mangrove trees to complete the work, must on no account be omitted

The Akee Tree—Blighia sapida.

This is a tree originally found in West Africa belonging to the natural order *Sapindaceæ*. It is also known under the name Cupania, that of Blighia being given it in honour of Captain William Bligh, of H.M.S. "Bounty," who imported the plant, together with the Bread-fruit plant, from the island of Tahiti to the West Indies over a hundred years ago.

It grows to a height of some 30 feet with a spreading head but till about 20 feet high is a handsome ornamental tree of a pyramidal form. It bears a fruit which is a valuable esculent and highly prized by Europeans in the West Indies.

It has been cultivated more in the island of Jamaica than elsewhere and till a few years since only a few trees were growing in Demerara, some half dozen being in the city of Georgetown. Latterly others have been grown in various parts of the colony, though to no great extent In the Botanic Gardens it has never reached its fruiting stage, generally dying out in two or three years, but in the old Military Burial Ground at Eve Leary some planted in the year 1900 fruited in six years. One plant, a handsome young tree in the Promenade Gardens, has been fruiting regularly for several years. It has two seasons of fruiting, a light one in the spring about the month of March and a heavier one in the autumn about September or October.

The leaves are large, pinnate, in four and five pairs, occasionally six pairs of leaflets. These oblong in shape about 9 inches by 3 inches, of an ordinary shining green above and pale dull green beneath ; the veins are prominent, regular, about ⅜ inch between them. The flowers are small, borne on racemes 6 to 9 inches long, pendant from the axils of the leaves. The fruit is a succulent dehiscent capsule, a very pretty object, hanging like a crimson and yellow egg, 2½ to 3 inches long and 2 inches wide, three-sided. When ripe it opens in three valves, splitting down the middle of each side, disclosing three thick cream-coloured nut-like masses ; at the base of each is embedded a shining black seed as large as a good sized marble. The case of the fruit is leathery about ¼ inch thick. The cream-coloured masses, botanically known as "arils," are the parts used for food ; they are formed of two lobes having a pink coloured integument between them which attaches them to the centre of the fruit.

The fruit must be picked fresh, *i.e.*, as soon as it splits open, because if allowed to hang long exposed to the air the arils become discoloured and stale, and are then unfit for food. Ants

are very fond of the arils so that when the fruit is picked it must be placed where these pests cannot get at it.

To prepare for use break open the fruit and detach the arils with the seeds, then break out the seeds. Split the arils in two and take out the pink-coloured integument; this is the portion which must be avoided as it is considered to be highly poisonous. In whatever way the akee is used it should be washed in salt and water to ensure its being perfectly clean. I cannot do better than give the late Mr. Jenman's receipts for the cooking of this delicious vegetable—for as a vegetable it is always used though it may be eaten raw—as he was a connoisseur in the matter and was the means of making the use of it largely known in the colony, gathering the fruit whenever he could get it, having it cooked in various ways and distributing it to whoever cared to try it. These are taken from his publications in "Garden, Field and Forest" in the year 1888:—

> "First I will describe the making of the well known dish salt fish and akees. After careful cleaning and washing put the akees into boiling water in which a good pinch of salt has been thrown and boil slowly for ten or fifteen, minutes, being careful not to boil too much. The use of boiling water is essential; if cold water be used the substance loses its firmness and becomes soft and watery before the boiling heat is reached. When they have boiled the required time, pour the water off and drain as dry as possible. In the meantime the saltfish has been boiled in the ordinary way; it has been shredded with a fork, and all the bones carefully removed. Then take both fish and akees, adding butter or lard according to taste, and mix them together; in doing so being careful, for the sake of effect when the dish is placed on the table, not to break the akees too much, and serve hot.
>
> "Akees may also be used for making fritters. For this purpose boil in the same way, drain dry, and beat them up with egg and seasoning. Fry and serve hot. The fritters may be modified by the addition of other substance in the making, such as fish or potato.
>
> There is a famous dish called "Twice laid." This, too, is composed of saltfish and akees, but it is somewhat differently prepared from the dish of the latter name. Either shred the fish very fine, all bones having been removed, or pound it in a mortar. Then take an equal quantity of akees, which have been boiled and drained as before directed, and beat them up with egg, butter, or

lard, making it into a thick paste. Add seasoning. Then take a pie-dish and in it place alternate layers of the prepared fish and akees till the dish is full, the top layer being akees, and place in a quick oven to brown, serving hot as usual. If akees are scarce a portion of boiled Irish potatoes may be employed, mashed and beaten up with them. If the fish and akees or other ingredients were mixed together first, instead of being placed in layers, much the same result would be realized.

"Lastly, akees may be boiled or fried and served as a side dish, and, cooked in the former way, with a little butter over them, an excellent dish they make too, though, personally, I regard this as the least desirable way to use them, it being rather a waste of good material for other dishes. Doubtless other ways, too, of preparing akees will occur to skilful or inventive cooks now that I have said so much."

JNO. F. WABY.

Poultry Farming.

It has always seemed to the writer that more could be done with poultry in this colony than is, at present, the case. Like everything else too often attempts have been made by those who personally have little or no liking for stock and have left most of the work to their subordinates—with the inevitable result of failure. Success, in anything of this sort, can be gained only by the giving of one's own personal attention to every little detail. The old time Gervase Markham, writer of plays and of agricultural treatises, in the days of James I. and Charles I., knew what he was talking about when he wrote that the "best doung for the field" was "the master's foot" and the "best provender for the horse the master's eye."

The wives and daughters of our small farmers ought to be able to find time to devote to this question, even if the "good-man" himself is too busy with his work "aback."

There is undoubtedly room for a better class of bird suitable for table purposes, for it is a well-known fact that the best of our birds are but poor, pitiable products of the local poulterer's care.

The first thing necessary is to see that your fowl-house is well-drained. Damp or wet houses spread and produce disease as quickly as anything else. The next thing is to try and improve your breed by introducing fresh blood as often as you can. For this, the best plan is to pick out some eight or ten of your best hens and pen them up for sometime with a pure-bred Plymouth Rock or Langshan cock and then "set" the eggs obtained from them; in this way there will be a gradual weeding out of most of the mongrel hens. The breeds, perhaps, best suited to this colony are as follows: Plymouth Rocks, Wyandottes, Langshans, Brahmas, Leghorns, and Minorcas, Dorkings and Indian Games. That is to say strains of blood from birds of the above standard varieties should be introduced—not that these pure-bred birds must be kept themselves, that is the business of the poultry-fancier, not the practical poultry farmer. One can often introduce fresh blood by exchanging or borrowing male birds. As you make it your business to introduce this fresh blood as often as possible, so you should get rid of the worst of your mongrel birds, which in the end prove only a waste to the farmer. Also hens should never be kept for breeding purposes after their second year has passed.

The fowl-house itself will be all the better for being as light as possible, as there will then be less chances of vermin being harboured. The perches for roosting must be *rounded*, it is cruel to give a fowl square perches to roost on. An uncomfortable and ill-suited perch very often causes a considerable amount of mischief, in the case of chickens especially, often being responsible for crooked breast-bones and other deformities.

When the fowls are let out at six in the morning, have the pen thoroughly cleansed and swept. Remove all droppings and carry to the compost heap or plough such stuff as may be removed in a month or two, into the ground around your Avocado Pear and other fruit trees. If you have a large quantity of eggs on hand and should the market price incline you to "hold" for a bit, preserve the eggs in lime water. Take the eggs straight from the nest and put them in the following mixture. Put two quarts of lime in a kerosene tin of water, boil the mixture thoroughly then allow it to cool, next pour off the clear water into a tin and put your eggs into this.

In feeding never forget to give your birds, green food of some kind, such as chopped leaves from the pigeon pea tree. It is advisable to give your birds an occasional feed of pounded bones, which should be charred before being crushed. Fresh water twice a day is a necessity and the drinking pans must be left in a shady spot.

Over-feeding is a fatal mistake. If all the food is not eaten, reduce the quantity. Any food left lying about to ferment will, if eaten by your birds, bring on disease.

As it is necessary for us to have a bath at least once a day, so is it necessary for your fowls. Have a suitable box filled with dust and ashes so situated as not to be able to get wet, you will find your birds will appreciate this dust bath immensely. Renew the dust and ashes every two weeks.

Never feed your youug and old birds together, as the smaller ones get shamefully bullied and generally are cheated out of their legitimate allowance. Use large flat boards for depositing the daily feeds and feed in a different spot each day, if possible. Change the diet as much as possible, as a rule our farmers give their birds too much Indian Corn. Beware of making this mistake. When Indian Corn is given see to it that is not given in whole grains, but crushed fairly fine. Occasionally give your laying hens a teaspoonful of linseed meal each, mixed with their daily feed, three times a week. Old tea leaves, a nest of wood ants and Sunflower seeds all come

in handy for an occasional feed, and are very useful. Grit, such as bits of shell, &c., is absolutely necessary, while cheap meat shredded or boiled down, or such despised fish as "lugger lugger," "corass," &c., boiled to rags, form an excellent diet from time to time. Even hardbacks, marabuntas, pond-flies, will prove extremely useful food, for your young growing birds especially.

Lastly, do not forget to change your male birds occasionally and *never permit your birds to breed in.*

EDGAR BECKETT.

The Sago Palm.

A new arrival in British Guiana on inquiring how it is that such a favoured land as this, both in soil and in climate, only exports sugar and rum as agricultural products worthy of mention, though rice has within the last 12 months figured largely in the same list, and imports every day food requirements such as groundnuts, potatoes, butter and indeed many other things easily grown locally, is told in Georgetown that the farmer is too lazy, he only grows sufficient for his own consumption. Not satisfied with this reply the inquirer goes out into the country and interrogates the farmer, questioning him as to why he does not grow this or that, the reply nine times out of ten is that he is quite willing to do so, but has not the capital necessary to drain and improve his land in order to ensure remunerative crops. It is obvious even to a casual observer that but little can be done in this "land of water," one might say, without drainage and thorough drainage. The stranger concludes that both statements contain much truth but that the farmer might perhaps more correctly be termed unenterprising rather than lazy and that the opportunities afforded by the favourable natural conditions existing in this country offer exceptional inducements to energetic colonists to develop other industries and swell the list of our exports. It would be well for the farmer to realize that though he may not have means to put a large area under thorough drainage at once, it is no reason for him to sit down and repine, he should remember that a little accomplished each day by his own labour would soon amount to a considerable patch and realizing this he should never be idle while daylight lasts. However something can always be done and it will be the endeavour of this article to point out to our farmers one thing which can be done without any expenditure of either capital or labour, and which will give a return in vegetable food more rich and less variable in its produce than even rice which industry it is pleasing to see is taking such a hold on our farmers. Our subject is the Sago Palm.

DESCRIPTION.

There are four well-marked varieties of this palm which with the exception of one is the smallest of its species rarely exceeding 30 feet in height, on the other hand its stem is one of the thickest. Two only of these varieties need be mentioned here, the *Metroxylon Rumphii* and *Metroxylon læve*, the former being spiny and the more productive, the latter smooth. In the early period of its growth, and before the stem has formed, this palm

(*M. Rumphii*) appears like a cluster of so many shoots, and until the stem has obtained a height of 5 or 6 feet it is covered with sharp spines, which afford it protection from the attacks of the wild hog and other animals. When from the strength and maturity of the wood this protection is no longer necessary the spines drop off. Before the tree has attained full growth, and previous to the formation of fruit, the stem consists of a thin hard wall, about two inches thick, and of an enormous volume of a spongy medullary substance. This substance is the edible farina, from which the inhabitants of the lands where it grows make their bread. Sago meal is eaten by the natives in the form of porridge, and also in the shape of biscuits two inches long, two broad and half an inch thick, analogous to local cassava bread, and which will keep for a long time. It is cooked by simply dipping the cake in warm water, which softens it; it is also made into soup. An old writer gives this description of obtaining the meal from the palm. "Meal is produced out of the said tree thus:—They be mighty huge trees and when they are cut with an axe by the ground, there cometh out of the stock a certain liquid like unto gum, which they take and put into bags made of leaves, laying them for 15 days in the sun and at the end of those 15 days when the liquor is thoroughly parched it becometh meal. Then they steep it first in sea-water, washing it afterwards in fresh water and so it is made very good and savoury paste whereof they make either meal or bread as they think good."

PROPAGATION.

The sago palm may be propagated from seed which varies considerably in size from an almond up to a hen's egg; it may also be propagated and far more rapidly by planting the young shoots, which the growing tree throws out in all directions.

SOIL.

The most suitable soil is a wet alluvial deposit, marsh or bog composed of decayed vegetable matter near the sea and *undrained*, with stiffish stuff underneath. How closely this requirement is answered by the lands of British Guiana it is unnecessary to emphasize. Rumphius after whom the variety first mentioned is named says:—"The tree grows best in miry or watery soil, where men sink to the knees in mud. It will grow in gravelly soil, if only it is charged with moisture and hence no plantation of the Sago Palm will thrive where there are not one or more rivulets of water. A bog knee-deep is consequently the best site for a sago plantation.

Cultivation.

It is considered advisable to plant not closer than 10 feet apart or 435 trees to the acre, although in the immense forest in which it grows many large stems are not more than 6 feet apart. After this it requires no further attention, unless the variety *Metroxylon læve* is being raised when it will need to be protected from the ravages of animals, the spiny variety being self-protecting. When a plantation arrives at maturity the natural mode of growth secures a constant succession of new plants from the time those first planted have begun to extend their roots, and the succession can be regulated by the knife in any way the planter desires.

Harvest.

There is no fixed season for extracting the pith which is taken as individual trees ripen, which much depends on the soil; experience will teach the proper time to harvest a tree. Generally this is indicated by fructification, but may also be tested by boring a hole and testing a small quantity of extracted pith. If a tree is not harvested it gradually dries up inside and becomes hollow and dies. When the pith is ascertained to be ripe the tree is cut down near the roots and the trunk divided into 6 or 7 feet lengths each of which is split open and the medullary substance extracted. In Borneo the tree ripens in about 8 years, but somewhat longer might be taken for an average. The tree grows so easily that in many places it is planted for ornamental purposes. The rate of production is nothing short of astounding and the following output is recorded in the "Journal of the Indian Archipelago:" "Three trees yield more food than an acre of wheat and six times more than an acre of potatoes. An acre of sago cut down at one harvest will yield 5,220 bushels, as much as 163 acres of wheat so that according as 7 or 15 years is allowed for the growth of the palm, an acre of sago is equal to an annual production of 23 to 30 acres of wheat."

Fruit.

Apart from the pith the fruit forms an abundant and nourishing diet, a basket of fruit will support 7 persons for a week, and a good tree will produce 30 baskets at a crop. The fruit keeps well under water.

Preparation.

When the pith has been extracted as described it is at once reduced to powder with an instrument of bamboo or hardwood.

The process of separating the farina from the accompanying bran and filaments is simple and obvious, and consists merely in mixing the powdered pith with water and passing the water charged with farina through a sieve at one end of a trough in which the mixture is made. This water is again passed through a second vessel when the farina settles down to the bottom, and after two or three more washings is fit for use and will keep without further preparation for a month. But for export the finest meal is mixed with water and the paste rubbed into small grains of the shape and size of coriander seeds, and is then termed Pearl Sago.

Several young palms may be seen growing in the Botanical Gardens, having made excellent growth since they were planted two years ago. The spiny variety appears more energetic than the smooth one, these trees being already 8 feet high, quite two feet higher than the smooth kind, all look the pictures of health, though they might have done even better had they been set out in some of our swamp lands rather than in the drained soils of the Gardens.

Pearl Sago.

This article will conclude with a description of the only remaining step, the manufacture of the Pearl Sago, thus showing that the whole process from planting out to exporting the finished article is of the simplest nature, in fact the manufacture of Pearl Sago is entirely in the hands of Chinese.

The tampins or leaf bags of sago having been dried as described are placed in heaps in a shed and opened, the contents being cast on an inclined plane 12 feet square, surrounded by a rim 2 inches high and there the sago now massed together is broken up. The first process to which it is subjected is a thorough washing without which it would remain impure and coloured. For this purpose strong tubs are employed 12 inches deep, 40 inches diameter at the top and 36 inches or more at the bottom bound by hoops. A coarse cloth is fastened over the tub slack enough to act as a strainer, the moist sago poured into this strainer is broken up by hand, and agitated until all its fine particles pass through the cloth and descend to the bottom of the tub, the residue is thrown aside. Considerable rapidity is acquired after practice. The sago is next stirred for about an hour, after which it is left to stand for 12 hours when the water is ladled out, and the sago, which fills about half the tub is removed to undergo the last purifying process which proceeds the granulation. This is performed in a simple manner, being an adaptation of the mineral sluice box Two tubs

are placed at a distance of 10 or 12 feet from each other, and connected with troughs raised by a framework above them. These troughs are about ten inches deep, 14 inches broad at the top and 11 inches at the bottom, one end being closed and the other open, fitted with grooves in the sides and bottom into which fit ripples ⅜ inch thick. The end of a piece of cloth, the breadth of the trough, being placed over the groove at the bottom, the shortest of the sticks is pressed down upon it, and the cloth thus fastened, is made to hang down over the end of the trough into the tub below. The tub at the after-end now receives the sago to about two-thirds of its depth, when it is filled up nearly to the top with water. The sago is now stirred until the water attains a milky appearance, when it is poured into the trough. To prevent it falling abruptly an inclined piece of wood, 8 inches broad, is fixed across the trough so as to leave only a narrow slit between it and the end of the trough. The water poured on this descend into the trough and slowly flowing to the other end deposits a portion of the sago in its progress. The suspended cloth becoming saturated, serves at once to maintain and equalize the overflow of the water into the tub below. When the water is poured in the first waves advance rapidly and carry away much of the sago but those that succeed deposit the greater part of their more solid contents transporting into the tub only the lighter fibrous particles which it is the object of this operation to separate from the farina, and by the time the operation has been repeated at another trough the water flowing down the cloth in the first has lost its whiteness. The process is continued until the deposit rises nearly to the level of the stick, when the sago next to it, which generally contains some impure sediment, is taken up in the fingers or thrown into the tub. The second stick is now fixed above the first, a fold of the cloth being interposed between them to prevent any liquid sago escaping through the seam and the operation goes on as before. When the milk in the upper tub begins to grow shallow it is again filled up with water and more sago stirred up and mixed with it. During the interval and at other more prolonged interruptions, the water in the troughs has had time to deposit all its contents, the last being a fine fibrous matter, which if not run over would leave a thin yellow layer. The surface is therefore washed with the hand until this layer is effaced and held in suspension. When the troughs have gradually been filled up in this manner described, by a succession of deposits, and the wall built up to the top by the last stick the sago is left to consolidate for 12 or 14 hours. The fecule which passes out of the troughs in the current is afterwards thrown into one of the tubs, whose contents are to be washed and deposited in their turn, and some of it may

pass through the process many times before it sinks into the trough. In order to give it the degree of dryness required it is exposed for one day in the sun in lumps one cubic foot in size which are placed on tables standing in the open air. Large mats are kept in readiness to cover it if rain falls. It is next taken into a large shed and again pulverised after which it is passed through a sieve 30 inches by 20 inches of which the bottom is formed of parallel fibres from the stem of the cocoanut palm leaf, kept in their position by strings which cross them at distances of about 2 inches. The lumps which do not pass through are thrown back on the heap. The next step is the pearling. The sifted sago is placed in a cloth, of which the ends are tied to a long stick, and that is kept expanded in a bag shape by a short cross stick. A horizontal vibrating motion is given to this, the whole mass being kept in constant agitation and every part successively driven along the sides of the bag. This lasts for about a minute, when the now granular sago is again passed through a sieve similar to the preceding one, but the smaller grains which pass through are the rejected ones. Those that remain are transferred to a circular sieve, of which the bottom is formed of fine strips of bamboo crossing each other. The grains which pass through the square holes thus formed are the pearl sago of commerce in the unroasted state, those which are too large are treated again. The roasting takes place in a row of iron pans, each about 2½ feet in diameter, which are built into a platform of masonry about 15 feet long and 4 feet in breadth covered with flat tiles. The pans rest in an inclined position, partly against the back of the platform which rises about a foot above the level, and partly on a small prop of brickwork on the right side, an off-shoot from the wall. Into the top of this prop a plate is sunk in which a cloth saturated with water is kept. Behind each pan is an open furnace mouth, and a man constantly attends the fires to maintain a moderate heat.The pan being gently rubbed with the cloth, a man who sits in front of it on a low stool on the platform pours into it a quantity of granular sago. This he slowly stirs for a short time with a wooden implement having a sharp curved edge. More sago is poured in and as it hardens, he uses the implement more freely. After about 3 minutes roasting it is removed to a table and passed through a round sieve. The grains that adhere to each other are thrown aside and those that pass through form a smoking heap, which is allowed to lie undisturbed for about 12 hours. The grains are about the same size they were before roasting and retain wholly or partially their white and mealy appearance, but the greater part have become translucent and glutinous, and all have acquired a certain degree of toughness,

although still soft. The final process is another roasting, which renders them hard and tough and greatly reduces their size.

This forms the Pearl Sago of commerce. Considering how easily this palm is grown, its immense yield and the simplicity of preparing the crop for market, it is hoped that some of our farmers will substitute such a remunerative tree for manicole in the undrained portions of their grants.

W. M. SMYTH.

Sugar Cane Experiments.

The following extracts are taken from the recently published Progress Report of the Agricultural Experiments carried on under the control of the Director of the Department of Science and Agriculture for the period from April 1906, to September 30, 1907.

Effects of Nitrogen.

The effects of nitrogen on the canes were as follows, the results being given in tons of canes per acre :—

	No Nitrogen.	Low Nitrogen. (200 lbs. Sulphate of Ammonia per acre.)	High Nitrogen. (300 & 400 lbs. Sulphate of Ammonia per acre.)
4th Ratoons North Field Means *	25 6	32·2	37·6
3rd Ratoons Do. Means	21·7	28·4	31·3
Plants and 1st Ratoons Do. Means	22·1	25·7	32·9
1st Ratoons South Field Means	11·5	17·8	23·9

As in every crop since the commencement of these experiments the yields of the sugar-cane have been dependent on the proportion of available nitrogen added in the manures and this is as true of the new varieties as of the Bourbon and of the White Transparent.

Effects of Phosphates.

Half of the older plots in North Field were dressed in June, 1901, with slag phosphates applied at the rate of six hundredweights per acre. The mean results have been in tons of canes per acre :—

	No Phosphates.	Slag-Phosphates.
1902 Plant Canes	68·6 ...	... 68
1903 1st Ratoons	35·2 ...	... 36·1
1904 2nd "	21·5 ...	... 22·3
1905 3rd "	26·5 ...	... 27·2
1906 4th "	30·4 ...	... 31·2
Means 1902-1906	36·4 ...	... 37

* (In the extracts here produced for want of space the means only are quoted. The full results for the several varieties of canes experimented with will be found in the report,—Ed.)

Three varieties growing as 3rd Ratoons and one variety grown as Plant-Canes occupied sixty plots on this field. One third of the plots received at the planting of the canes slag-phosphates at the rate of 6 cwt. per acre, one-third received "basic super-phosphate" at a similar rate, whilst the remaining third did not receive any phosphatic dressing. The results in tons of canes per acre were as follows:

	No Phosphates.		Basic Super-Phosphates.		Slag-Phosphates.
No Nitrogen. Means	21·1	...	20·7	...	20·9
Low Nitrogen. Means	25·4	...	26·2	...	26·2
High Nitrogen. Means	30·0	...	30·8	...	28·0

On South Field using 42 plots with varieties as first ratoons the mean returns were :—

	No Phosphates.			Slag-Phosphates.
No Nitrogen. Means	10·3	...	...	12·6
Low Nitrogen. Means	18·6	...	..	18·3
High Nitrogen. Means	25·9	...	...	24

On the field (North field) the soil of which yielded a mean of ·0075 per cent. of phosphoric acid to one per cent. citric acid solution one series of experiments showed a mean yield of 30·4 tons of canes without phosphates and one of 31·2 with, whilst in the other series the yields with and without phosphates were practically identical.

On the soil which yielded a mean of ·0108 per cent. of phosphoric acid to the citric acid solution the mean yields were the same both with and without phosphates.

On North field the mean annual yields during five crops of plant canes and ratoons have been 36·4 tons of canes per acre without phosphates and 37· tons with.

These results confirm the conclusion arrived at that if a heavy clay soil in this colony yields more than ·008 per cent. of phosphoric acid to one per cent. citric acid solution under conditions of continuous shaking for five hours, in all probability manurings with phosphates will not produce commensurately increased yields of sugar cane.

Effects of Lime.

On the forty-two duplicate plots on South field, one of each

of which is on land limed in 1891, the other on land not then limed, the following results were obtained :—

	Not Limed.			Limed.
No Nitrogen. Means	10·1	...	...	13·
Low Nitrogen. Means	14·8	...	...	16·8
High Nitrogen. Means	23·1	...	...	23·5

The mean yield of all the plots on the not-limed land was 18·2 tons of canes per acre, that of those on the limed land 19·6 tons.

The effects of the 1891 liming of the soil were, therefore, still apparent in the crop of 1906.

DISTRIBUTION OF VARIETIES OF CANES.

One hundred and ninety-eight mule-cart loads of canes were distributed during December, 1906, to the various plantations which applied for them. The varieties most in request were Nos. 625, 3,956, 145, 109, 4,397, 2,468, B147, and B208. Supplies of Sealy, 1,087, and 848, as well as of several of the varieties raised in recent years were also asked for.

There can be no doubt that it is advisable for cane-farmers on the coast-lands to plant either D109, D145, D625 or B147 in place of the Bourbon, whilst farmers on the lighter river-lands should try D145 or B208.

Experiments with Rice.

The following account of the experiments with rice carried on under the control of the Director of the Department of Science and Agriculture at the Experimental Fields of the Botanic Gardens is reprinted from the Report already referred to under " Sugar-Cane Experiments."

Varieties under Experiment.

In April, 1906, seventy-nine different varieties of rice were sown on the seed-beds at the Experimental Fields. Among these were included the ordinary Creole rice, the Berbice Creole rice, Carolina Golden Grain, Japan rice, Honduras rice and Carolina rice, forty-two Ceylon varieties and twenty-two varieties received from Dr. Van Hall, the Royal Commissioner of Agriculture for the Dutch West Indies. Of the varieties sown thirty-seven were Upland, Hill or dry rice, the remainder being Lowland or wet rice.

Manurial Experiments with Phosphates.

The rice-beds were prepared and manured in May, the manures used being slag-phosphates, super-phosphate of lime and the so-called " Basic super-phosphate of lime," a super-phosphate neutralised by addition of lime in accordance with a suggestion of Mr. John Hughes, F.I.C., etc., Chemist to the Ceylon Planters' Association. The experiments were arranged so as to allow of a comparison of the increases, if any, due to these various phosphatic manurings.

The first-mentioned was applied at the rate of six cwts. to the acre, the two latter at the rate of 4 cwts. per acre.

The transfer of the young rice-plants from the seed-beds to the Experimental Fields was commenced in the first week of June and completed by the 20th.

The varieties were practically all in ear in August whilst the Japan dwarf rice ripened during that month and was reaped on the 29th. A commencement was made of the general reaping in the second week of September and this was completed in the first week of October.

In January, 1907, a clearance was commenced for an extension of the rice-field. After the land was cleared it was fenced with barbed wire so that the whole of the Experimental Rice-field is now surrounded by a ring-fence.

In February the irrigation system was re-modelled so that the water for this field is now obtained independently of the wide trench in the Avenue of the Botanic Gardens, thus preventing wastage. By the end of March all the beds in the extension which are to be used for rice-experiments were ready for this purpose. They were forked and prepared for actual planting early in May.

The seed-beds were sown on April 17, and the young plants were transferred to the experimental plots on from the 22nd to the 30th of May. Certain of the plots were again manured in accordance with the system mentioned above.

Comparative Yields of Paddy.

The following shows in bags of 120 lbs. the yields in paddy during the two seasons under report compared with those recorded in 1905 :—

Variety.	1905.	1906.	1907.	Mean.
British Guiana Varieties				
Creole Rice	34·	42·	33·	36·
Berbice Creole Rice ...	23.	22·5	18·	21·
Ceylon Upland Rices				
No. 1.	18·5	47·	20·	28·5
" 3.	31·5	45·	32·5	36·
" 4.	27·5	34·	32·	31·2
" 6.	42·5	42·5	32·	39·
" 34.	...	32·5	15·	23·5
Ceylon Lowland Rices				
No. 17.	38·	28·	15·	21·5
" 18.	...	41·	26·	33·5
" 39.	...	34·	21·	27·5
" 41·	...	36·5	16·	26·
" 43.	...	37.	13·	25·
Louisiana Rices				
Carolina Golden Grain	22·5	19·	17·	19·5
Carolina	...	24·	14·	19·
Japan (dwarf) ...	20·0	11·	7·5	13·
Honduras	22·5	23·	13·	19·5
East Indian Rice				
Sur Dhani	34·	34·	35·	34·5

Sixty-two other varieties were under experiment in 1906 with results already reported.

Messrs. Wieting and Richter kindly examined by milling samples of the varieties raised in 1906, and expressed their

opinion that of the imported varieties "Nos. 6, 4 and 75 (Sur Dhani) are the most suited for the local trade, the first-named especially being the long grain rice which is saleable."

This opinion is of great importance as it shows that No. 6—the heaviest yielding variety we have cultivated—is also the one most suitable for our local market.

RESULTS WITH PHOSPHATIC MANURES.

The following are the mean results of the trials of various kinds of phosphatic manures:—

	Bags of Paddy (120 lbs.) per acre.			
	1905.	1906.	1907.	Means, 1905-07.
No Superphosphate	34·9	30·	23·6	29·5
With Superphosphate	31·6	32·	24·2	29·3
No Slag Phosphate	30·1	36·5	22·7	29·7
With Slag Phosphate	30·	36·	22·4	29 5
No Basic Superphosphate ...	30·8	30·1	22.1	27·7
With Basic Superphosphate ...	33·5	30·7	22 6	28·9

During these trials one hundred comparisons without and with phosphates have been made and 63 resulted in higher yields on the plots dressed with phosphates than on those not so dressed. In the case of basic superphosphate 69 per cent. of the manurings, in that of superphosphate 64 per cent., and in that of slag phosphates 52 per cent. were accompanied by increased yields. In the remaining cases the yields were lower on the plots manured with phosphates than on those not so treated.

From this it may be concluded that dressings with phosphates are advantageous to rice.

The relative advantages of the different forms of phosphatic manuring may be inferred by eliminating from consideration the results where the manurings were followed by lessened yields. The following gives the mean results thus arrived at:—

	Bags of Paddy (120 lbs.) per acre.			
	1905.	1906.	1907.	Means, 1905-07.
Without Superphosphate ...	42·8	30·6	21·2	31·5
With Superphosphate	44·2	32·7	22·7	33·2
Without Slag Phosphate ...	33·2	37·5	23·4	31·4
With Slag Phosphate	35·5	39·6	26·5	33·7
Without Basic Superphosphate	25·2	27·7	21·6	24·8
With Basic Superphosphate ...	28·0	29·8	23·7	27·2

This shows that, presuming the plots which showed phosphatic manurings were of equal fertility to those not so manured,

increases of 4·7, 7·3 and 9·6 per cent. as due respectively to the dressings with superphosphate, slag-phosphates and basic superphosphate.

TRIAL OF NEW MODE OF PLANTING.

Trial was made in 1907 of a mode of planting strongly recommended by the Emigration Agent in India for adoption in British Guiana. This consists in planting singly carefully selected plants in the holes in place of two or three plants as is usually done here; the following are the comparative results obtained:—

	Bags of Paddy (120 lbs.) per acre. Single plant to a hole.	Two or Three plants to a hole.
Colony Creole Rice ...	... 37·2	32·3
Berbice Creole Rice ...	... 30·0	17·2
Ceylon Upland Rice No. 3.	... 32·0	32·6
" " " 4.	... 28·5	31·3
" " " 6.	... 38·	32·5
Sur Dhani Rice ...	... 28·7	33·7

As is usually the case in experiments of this sort the results with different varieties are conflicting. The mean yields of the singly planted plots is 32·4 bags of paddy per acre whilst that of the more crowded plots is 29·9 bags.

These comparisons will be repeated as opportunity offers.

Wide Planting of Para Rubber.

In the "Hints on Planting Para Rubber" published in Vol. I., No. 1., p. 24 of the Journal of the Board of Agriculture, in dealing with the proper distance apart to plant the trees, mention was made of the great diversity of opinion on this subject and stress was somewhat laid on a method of close planting, 10 feet by 10 feet, with the object of tapping a certain proportion of the trees to death each year starting from the end of the 4th or 5th year and so providing for the further growth of the remaining trees.

Among the advantages claimed for this method, it was pointed out that close planting kept down the expense of weeding as the trees shaded the ground more quickly, that it provided a larger available tapping area of the trunks per acre and that a certain amount of rubber could be obtained in a shorter time than with the ordinary planting at wider distances apart.

Although the prospect of obtaining some return for one's outlay at the end of the 4th or 5th year by following the method of close planting, is very attractive, practical experience seems to be rather in favour of wide planting as likely in the end to prove more profitable. The following are the opinions of two writers who speak with the authority based on observation and experience of rubber cultivation and who support the practice of wide planting.

In his report for the year, 1906, Mr. J. B. Carruthers, Director of Agriculture and Government Botanist for the Federated Malay States, discusses this subject as follows :—

"Planters have begun to see the value of giving their trees plenty of room, and the argument that to plant more trees than is intended to permanently keep has been seen to be both fallacious and dangerous. Fallacious, because with prices at 5s. and more per lb. and with a very reasonable hope of continuance of such prices, owners will not keep to their intentions in thinning out trees which are "giving them a profit of $1 or $2 each ; and dangerous because if they did steel their hearts and cut out their trees the policy of leaving large numbers of dead rubber roots among healthy trees is one which any one acquainted with root diseases, both due to fungi and insects, would condemn as running serious risks of encouraging that most insidious type of pest.

"The practice now very general, of planting at unequal distances —i.e., in avenues of trees 24ft. by 30ft. or 20ft. by 17ft., has many

advantages. It admits direct sunlight all over the ground for a short period every day. The sun is the cheapest and most effective weapon against the attacks of fungi and bacteria that the planter possesses. When the trees are 10 years old or more the avenue system allows of a quicker and more effective supervision of the health and vigour of trees, and is a help in enabling the Superintendent to easily locate trees on the estate for ordinary or for disease prevention work.

"As to the exact distance which trees should be planted, situation, soil, rainfall and other factors must be considered, but it is better with an eye to the future to err on the side of planting too few rather than too many."

In "The Tropical Agriculturalist" for July, 1907, an article by Mr. Ivor Everington was published on "Wide Planting of Para Rubber" from which the following extracts are taken:—

"A very practical argument in favour of the advantage claimed for wide planting is shown in the results obtained on the Highlands and Lowlands estate, in the Federated Malay States. A block of Para rubber trees 16 acres in extent, contains 807 trees planted 30 by 25 feet. These trees are 9 years old and already they 'completely cover the ground' in the words of Mr. R. W. Harrison, the General Manager of the Highlands and Lowlands Rubber Co., in his annual report for 1906. Thus each tree has an average spread of foliage of 750 square feet, and consequently the trees must be far healthier and stronger than close-planted trees, having a limited space of say 100 to 200 square feet before the branches interlace with those of neighbouring trees; and it is a reasonable deduction to suppose that their recuperative powers under the strain imposed by tapping operations will be proportionately greater.

"The tapping results in yield of rubber from these trees is rather remarkable. Over the whole estate the year's crop of rubber amounted to 95,333 lbs. this was obtained from 33,967 trees tapped all through the year, and 4,672 trees lightly tapped during the last half of the year, which gives an average yield of 2·46 lbs. rubber per tree per year. But from the 807 widely planted trees the yield during the year was 5,742 lbs. rubber, giving *an average of 7·01 lbs. per tree.*"

"There is another point in favour of wide planting, that is the greater amount of soil in which the ramifications of the root system may travel and obtain nourishment. The tap root of Hevea brasiliensis goes down to a considerable depth and the

lateral roots are very free growing. Taking 3 feet as the depth to which the lateral roots descend in mature trees—for in Hevea they are of rather a superficial nature—the Highlands and Lowlands trees, planted widely have 30 x 25 x 3 = 2,250 cubic feet of soil each in which to find nourishment, before there is any interlacing of roots.

In comparatively poor soil if the trees are very closely planted manuring will be necessary long before it would be required for trees in the same soil but widely planted; but, on poor soils, where the trees do not develop so quickly, closer planting may be adopted as a rule. From results already obtained a strong case may be made out in favour of wide planting on good soil."

To this article is appended a short note by the Editor "T. A.", Dr. J. C. Willis advocating a somewhat middle course between these two extremes.

"The general evidence seems to favour moderately wide planting. In Ceylon, say an average of 15 feet apart, wider in the low country and on good soils closer up-country or on poor soils. An idea widely circulated that the roots only grow outwards a foot a year appears to be based on the examination of one or two trees, for there are very numerous cases in which the growth has been observed to be much greater."

"Witch Broom" Disease of Cocoa.

Since the last issue of the Journal specimens of branches from cacao trees have been sent to me for examination and report which show that the destructive "Witch Broom" disease has made its appearance on another estate on the Demerara River and about 300 trees are said to be attacked by it.

The disease was first found in this colony in March, 1905, and described in a report on Cacao Diseases submitted to the Government in June of the same year. Shortly afterwards Mr. J. E. Beckett, Senior Agricultural Instructor, discovered the same disease to be plentiful on certain abandoned cacao estates along the Berbice River.

The correspondent who has sent me these specimens and who informs me in his letter that a large number of trees on his estate are attacked, as I have already mentioned, says that one of the specimens sent came from a tree of which 50% of the branches are in a similar condition.

For an estate to become so badly infected the disease must have been running its course for a considerable time and, as is so frequently the case, no notice is taken of it until very serious damage has been done.

In the last number of this Journal appeared an article on the "Importance of early attention to Plant Diseases," which I again desire to bring to the notice of everyone in the colony who has anything to do with agriculture. On another page in the same number a few directions are given on the way specimens of plant diseases should be packed and sent.

The "Witch Broom" disease is very easy to recognise and for the information of those who are interested in cacao cultivation, the following short account may be of some use:—

Characters of the Disease.

The disease is characterised by gouty or thickened enlargements appearing at the ends of the branches and many of the leaves borne on these swollen parts are brown and shrivelled. Also these enlarged twigs show a tendency to put out a number of other twigs which are more or less aborted and which grow together in small clusters somewhat resembling brooms, whence the popular name given to this disease.

Abnormal growths of a similar nature occur also on certain kinds of trees in temperate countries and either resemble brooms

or sometimes take the form of large birds' nests, for which they are sometimes mistaken.

The disease also attacks the pods and it is in this way that the worst damage is done because sometimes as many as 50 per cent. of the pods on a tree are diseased. When the pods are young they often show a swelling on one side, or sometimes the disease appears as an irregular discoloured spot which later becomes black.

The infected pods are distinguished from those attacked by other diseases through their becoming excessively hard, a characteristic which is described by a Dutch word "*versteening*" meaning petrifaction.

Cause of the Disease.

A parasitic fungus which can be observed only under the microscope and which has received the name of *Exoascus theobromae, Ritz Bos.* is responsible for this disease. As is the case with all the fungi, the seeds, or the spores as they are called, are exceedingly minute and are produced in very large numbers.

In all probability the starting-point of this disease is through a few spores being conveyed in some way, either by the wind or adhering to some bird or insect to a single tree on the estate from some other estate which is similarly infected.

If the disease is noticed at once as it can scarcely fail to be by a careful cultivator from the characters I have described and prompt and efficient measures taken to get rid of it, little or no damage will be done. But, if as is too often the case with plant diseases and insect pests, no notice is taken of it and it is allowed to spread for a time it may involve the whole or the greater part of a plantation and become very difficult and expensive to eradicate.

The Loss Caused by the Disease.

A considerable amount of injury to the cacao industry has been done by this disease in Surinam, where it was first noted in 1898 and the productive powers of the trees attacked have been very seriously impaired. Thus in 1899 the cacao crop was 3,526 tons, 5 years later, in 1904, it had become reduced to 843 tons, i e, to one quarter of the former yield.

These figures should be sufficient to show the very great importance of keeping a careful watch for the first appearance of the disease on every cacao estate in British Guiana and when any signs of it are noticed, taking immediate steps for its destruction.

Remedial Measures.

The methods which have been employed in Surinam with a view to stamping out the disease were described by Dr. C. J. Van Hall, Commissioner of Agriculture for the Dutch West Indies at the W. I. Agricultural Conference held in Trinidad in 1905.

They consist, first, in pruning the trees thoroughly so as to remove all diseased *branches*. It was found that the removal of only the diseased and enlarged twigs and broom-like growths was not sufficient, because the fungus *mycelium* extends for some distance down the branches, so these must be taken off as well. All the branches and twigs removed are to be carried out of the plantation and burnt.

Secondly, spraying the pods with Bordeaux mixture to prevent them from becoming attacked and ruined. The pods are liable to become infected with the disease when very young, therefore spraying must be done before the flowers open and when the buds first appear and the growing pods must be sprayed three or four times to prevent them from becoming afterwards attacked.

That spraying the pods has been productive of good results is proved by the fact that while the percentage of diseased pods on unsprayed trees was from 40 to 50 per cent. that on trees which were sprayed was only 17 per cent.

Together with these remedial measures steps are taken to keep the trees under as healthy conditions as possible by good tillage of the soil and digging in the dry leaves.

In 1905, a gentleman from Surinam informed me that the only estate in that colony which was not attacked by the disease was one called Maragaritenburg and that it was the only estate which dispensed entirely with shade trees.

On some of the estates in this colony that I have visited I have noticed that the Oronoque trees had either been planted too close together or had been allowed to grow too large and as a consequence the cacao trees were in my opinion much too heavily shaded. Excessive shading of cacao is liable to favour the growth of parasitic fungi, because the majority of fungi prefer damp and shady situations.

Results of Remedial Measures.

The measures adopted in Surinam in dealing with the "witch broom" disease, appear to have met with some degree of

success on the areas under treatment, because in the year 1906 the amount of the cacao crop had somewhat improved in comparison with the figures for 1904 and had reached 1,495 tons.

I understand, however, that the lack of concerted action on the part of the growers is the chief difficulty in stamping out the disease, because whilst some estates are adopting energetic measures with that end in view, there are other estates where little or nothing is done, and which in consequence remain permanent sources of infection.

In conclusion, the "witch-broom" disease is already present in this colony, therefore I cannot too strongly again urge on every cacao planter in British Guiana, the importance of great watchfulness and prompt action on his part, to prevent it from gaining a foot hold on his estate.

LEASES ON CROWN LANDS FOR RUBBER CULTIVATION.

The following amended terms and conditions on which Crown lands in British Guiana can be obtained for the cultivation of rubber were published in the "Official Gazette" for 5th October, 1907.

Applicants were at the same time informed that their applications must, as usual, be addressed to the Commissioner of Lands and Mines.

MEMORANDUM of Terms and Conditions on which Crown Lands in British Guiana can be obtained for the cultivation of Rubber under the Crown Lands Ordinance, 1903.

1. Leases to be given for areas of any size for a term of 99 years, with the right of purchasing the land at four dollars an acre at the end of ten years from the date of the lease if the conditions of the lease have been complied with.

2. The land to be given free of rent for first ten years. From the tenth to fifteenth year there shall be chargeable in advance an annual rent of 20 cents per acre on the total acreage of the Concession. From the sixteenth year onwards the rent shall be 50 cents per acre per annum.

3. For any Rubber, Balata or other like substances obtained on the land whether from indigenous or cultivated trees during the first ten years term of the lease, there shall be paid to the Government royalty at the rate of two cents per lb.

4. The Lessee to be required to plant up with Rubber trees to an average of not less than 60 trees to the acre, one twenty-fifth of the area each year until he shall have so planted up ten twenty-fifths of the total area of the tract and he must maintain such Rubber cultivation in good order.

5. In clearing the land for cultivation no Bullet tree or Rubber producing tree shall be destroyed without the permission in writing of the Commissioner of Lands and Mines.

6. The fees payable for obtaining a lease to be as follows:—

Report	$ 1 00
Advertisement	2 00
Survey for—	
(*a*) the first 25 acres per acre	50
(*b*) each additional acre	20
and in addition the actual cost of labour for cutting the survey lines.	
Iron Paal	2 00

The conditions to be attached to the Lease to be as follows:—

1. The Lessee shall commencing on the first day after the expiration of a term of 10 years from the date of the lease pay to the Commissioner of Lands and Mines an annual rent in advance of 20 cents for each and every acre of the tract leased for five years, and subsequently an annual rent of 50 cents for each and every acre, and in default of such payment on the day on which it becomes due, shall in addition pay interest at the rate of 6 per centum per annum on the amount remaining due and unpaid for each and every day of default.

2. The Lessee shall be bound to plant with Rubber trees to an average of not less than 60 trees to the acre each year commencing from the date of the lease one twenty-fifth part of the total area of the tract until he shall have so cultivated with Rubber trees ten twenty-fifths of the said total area, and he shall be bound to maintain the said cultivation in good order to the satisfaction of the Governor-in-Council.

3. There shall be paid during the first ten years of the lease on all Rubber, Balata or other like substances obtained from the tract a royalty of 2 cents per lb.

4. The Lessee shall not transfer his interest or any part thereof in the lands comprised in the lease, or any of them, save with the permission of the Governor-in-Council, such permission not to be unreasonably withheld.

5. The Lessee shall not give or deliver to any Aboriginal Indian any spirituous liquor as an equivalent for or in part payment of wages or for any work or labour done or performed for him by such Aboriginal Indian.

6. The Lessee shall place and keep on the façade of the tract leased to him on or near to each boundary paal, a board or tablet on which shall be painted in plain legible letters and figures the name of the Lessee, the length of the façade, the compass bearings and depth of the side-lines of the tract, and the number and date of the lease under which he holds it; and the Lessee shall keep such board or tablet with such

inscription in good repair during the continuance of the lease; and he shall also keep the boundary lines of the tract so far as he has cultivated or beneficially occupied clear and open at all times to the inspection and reasonable satisfaction of any Officer of the Department of Lands and Mines.

7. The tract of land leased shall be subject to the right of way across any portion of it to the Crown lands aback of the tract for the officers and servants of the Crown and Government of the Colony and others thereto authorized by the Crown or Government.

8. This Lease shall not confer on the holder any right to take or obtain Mineral Oil from any deposit that may exist in or under the land leased and all officers of the Crown or Government and other persons thereto specially authorized by the Government shall at all times have the right to enter such land for the purpose of obtaining Mineral Oil therefrom: Provided that the lessee shall have the right to compensation for any damage suffered by him in consequence of such entry and the obtaining of Mineral Oil from the said land.

9. The Lessee paying the rent hereby reserved and observing and performing all the covenants and conditions herein on his part contained shall and may peaceably and quietly possess and enjoy the land hereby leased without any interruption by the Lessor or any person lawfully or equitably claiming from or under him.

If any of the preceding conditions be not complied with including non-payment of rent within 15 days of its being due, the Lessor shall have the right to re-enter with payment of any compensation for buildings or other things on the land.

LIST OF IMPORTANT PAPERS ON AGRICULTURAL SUBJECTS.

The following is a list of the more important papers on various agricultural subjects which have appeared in the publications received in exchange by the Board of Agriculture since the last issue of the Journal:—

Cacao.

1. "Cacao Pests."
2. "Cacao Cultivation, Pruning and Soil Management."
3. "Cacao General Culture."

Proceedings of Agricultural Society of Trinidad and Tobago, Vol. vii., pp. 107, 131 and 203.

Coffee.

4. "Coffee Cultivation in Coorg"—The Tropical Agriculturalist, Vol. xxix., Nos. 2 and 3, pp. 117 and 190.

Tobacco.

5. "The Culture of Tobacco," U. S. Department of Agriculture, Farmers' Bulletin No. 82.

6. "Cultivation of Tobacco in Hawaii." Bulletin No. 15, Hawaii Agricultural Experiment Station.

Stock.

7. "The Selection and Milking of Dairy Cattle." Leaflet No. 187, Board of Agriculture and Fisheries, London.

Various.

8. "Melon Culture." Bulletin No. 6, Experiment Station of New Mexico Agricultural College.

9. "Turmeric Cultivation." The Tropical Agriculturalist, Vol xxix., No. 2, p. 134.

10. "Cassava: Its Cultivation and Manufacture." The Tropical Agriculturalist, Vol. xxix., No. 2, p. 126.

11. "Groundnut Cultivation in Burma." The Tropical Agriculturalist, Vol. xxix., No. 3, p. 197.

12. "The Coca Plant—Erythroxylon Coca." The Tropical Agriculturalist Supplement, Vol. I., No. 3, p. 170.

These papers may be obtained on loan by persons authorized to use the Library of the Board of Agriculture.

DISTRICTS ASSIGNED TO AGRICULTURAL OFFICERS.

Owing to changes in the personnel of the Department of Science and Agriculture, the following temporary arrangements have been made by the Director in the assignments to districts of the Officers of the Department:—

Mr. J. E. BECKETT,	Berbice.
Mr. A. L. MANSFIELD,	North West District.
Mr. N. R. KING,	West Demerara. Essequebo.
Mr. A. A. ABRAHAM,	East Demerara.

Officers will make themselves acquainted with the agricultural conditions in their districts so as to be able to report on the development of agriculture in them.

Farmers and others desiring visits to their cultivations from the Agricultural Officers should apply to The Government Botanist, Botanic Gardens, Georgetown.

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OF

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The Cultivation of Limes.

For the following notes I am indebted partly to an article on the "Cultivation of Limes" which appeared in "The Agricultural News," Vol. VI. No. 148, p. 414, and partly to an account of "The West Indian Lime," by Mr. A. J. Brooks, F.R.H.S., in the Journal of the Royal Horticultural Society for June, 1907.

CHOICE OF LAND.

The lime grows best in a light sandy loam with good drainage and at an elevation from sea-level up to 500 feet, with a rainfall varying from 80 to 160 inches in the year. The tree prefers sheltered situations and high winds knock off the flowers and young fruit and thus very seriously diminish the crops.

Lime trees will grow and sometimes produce a fair quantity of fruit in the stiff soils of the coast lands of British Guiana, but the conditions are unfavourable and the cultivation would be unprofitable. It is on the poor, sandy soils of the forest region that the finest trees are seen and the largest crops of fruit are produced, in fact most of the forest land is suited for growing limes.

SELECTION OF SEEDS.

Seed for planting purposes should be carefully selected from good-sized fruit, picked from healthy heavy-bearing trees. With some limes of good size and excellent quality recently received from Tumatumari it was found that 100 of the fruits contained 550 seeds, which may be of some assistance in estimating the quantity of fruits required to raise a certain number of seedlings. After removing the seeds from the fruits it is recommended that they should be well washed with water in a fine sieve to free them

from mucilage, the object of this being to afford a certain amount of protection from rats and mice.

The seeds are then to be dried in the shade but must be sown as soon as possible after they are dried, for they soon lose their germinating power.

Before sowing, all the small and imperfectly formed seeds should be sorted out and thrown away, because they are likely to produce inferior plants.

SOWING THE SEEDS.

In Dominica seed-beds usually 5 feet wide and 20 feet long are made in a corner of a field sheltered from heavy rains and the mid-day sun. The beds should be raised so as to ensure good drainage and the soil should be thoroughly broken up. The seeds are sown thinly in drills at a depth of about an inch, the distance apart of the drills being about 8 or 9 inches.

The practice followed in the Nursery of the Botanic Gardens here, which is recommended wherever possible, especially when comparatively small quantities of the plants are to be raised, is to sow the seed in shallow boxes, about 6 inches deep, filled with good loose soil to within an inch of the top of the box.

The advantages claimed for this method are, first, that the boxes can be easily moved under shelter during heavy rains, and secondly, that the seeds can be easily protected from the attacks of rats and mice by covering the boxes with pieces of wire-netting of ½ inch mesh. As protection from these pests will probably only be required during the night-time pieces of board may be used instead, but they should be put on the last thing in the evening and taken off early in the morning, as the seedlings will not thrive in the dark. The seeds must be sown thinly in the boxes so as to give the young plants plenty of room to grow.

TRANSPLANTING INTO NURSERY BEDS.

When the young plants are from 4 to 6 inches high they may be either transplanted into Nursery beds or into baskets.

The Nursery beds are made in the same way as the seed-beds, which has been already described. When the seedlings are large enough to transplant they should be lifted carefully with a fork and the soil shaken from the roots. The tap-root is then to be cut back to about two inches in length, which stimulates the production of surface roots and the leaves should also be cut off to prevent the plants from drying up for want of water.

The plants are then carefully transplanted into the nursery beds allowing at least 6 inches apart both ways.

Baskets, however, are in some ways to be preferred to nursery beds; their cost is small, they allow the plants to be easily moved about and to be planted out permanently in the cultivation without much danger of further disturbing the roots. The young plants from the seed-beds are transplanted into them in the same way as that recommended for the nursery beds.

PLANTING OUT.

Limes are planted at various distances apart according to individual opinion and locality. Trees planted at wide distances give better results when mature than those closely planted, for owing to the hemispherical shape of the trees they present a greater bearing area. Probably the most successful method will be to plant the trees 10 to 12 feet apart in the rows and 20 to 25 feet between the rows, which will make it more convenient for pruning, manuring and spraying also if required.

The holes for planting are to be dug about 18 inches both in width and depth, the soil taken out well mixed with some pen manure or leaf-mould and then put back into the hole so that it forms a small heap above the ground. This is done to allow for the earth settling which is certain to happen after a short time.

To give the soil time to settle it is advisable to prepare the holes for planting two or three weeks before they are required.

When the plants are about 18 inches high, which should be from ten to twelve months after the seeds are sown, they are ready to be planted out in their permanent places in the cultivation.

The plants should be taken up carefully out of the nursery beds without disturbing the ball of earth around their roots and placed in a hollow scooped out in the top of each heap. Care must be taken that in planting out the stem is not buried to a greater depth than in the nursery beds or the baskets. The soil is then to be filled in round the ball of earth and pressed down so as to hold the plant firmly. A good sprinkling with water after planting will help to settle the earth about the roots.

AFTER-CULTIVATION.

Very little after-cultivation is required beyond weeding the land from time to time. Some proprietors only weed for a distance of about three feet around each plant. The weeds

should always be spread as a mulch around the base of the trees as this practice has been found to produce good results.

Crops grown for green dressings are now being planted in lime cultivations to keep down the weeds during the growing season. They are cut down two or three times during the year and used for mulching the plants and at the beginning of the dry season they are pulled up and used for the same purpose. On the coast lands of Dominica, the Horse Bean (Canavalia ensiformis) has proved very useful, and the Bengal Bean has been used in Montserrat. Catch crops suited to the soil may also be grown between the trees, and in addition to keeping down weeds will yield some returns until the trees come into bearing. But, as the roots of limes run close under the surface, nothing should be planted too near to the trees.

To keep up the fertility of the soil, pen-manure or leaf-mould should be applied when either of them is obtainable. Grass or bush cut from adjoining lands may also be used with good effect. Too much stress cannot be laid upon the importance of keeping up the supply of humus in the soil by applications of pen-manure or of mulch.

A practice largely followed on lime estates is to cart all the skins of the fruit after the juice has been expressed from the mill to the cattle pens. The cattle eat these readily and thrive on them and any skins that remain uneaten are trodden down with the manure. The manure is covered over each morning with a layer of dry grass and allowed to accumulate until the end of crop time, when the pens are opened and the manure is carted to the land. By this method the land suffers but little loss. Where cattle are not kept another method of utilizing the skins and pulp is to spread them round the roots of the trees as a mulch.

Pruning.

Lime trees require very little pruning beyond the removal of all dead branches and suckers, and also branches lying near the ground which would hinder the women employed in picking up the fruit. The wounds made in pruning must be tarred and all the prunings should be burned, in consideration of the bare-footed workers on a lime estate.

Yield.

The lime may under favourable conditions bear a few fruit in the third year after planting, and in five to six years' time will

produce light crops, but eight to ten years is the time required to bring a lime plantation into full bearing.

A well-grown tree in full bearing should give from three-quarters to a barrel of limes each year.

Collecting the Fruit.

Except when the fruit is to be exported, the limes should not be picked off the trees. When maturity is reached the fruit ripens quickly, turns yellow and falls to the ground, and only the fallen fruit should be collected.

The advantages of following this practice are, first, that it ensures only ripe and mature fruit being gathered and so a more uniform juice is obtained ; secondly, the expense of picking the fruit is saved, which owing to the many spines on the branches would take a considerable time, and thirdly, there is no chance of the tree being damaged in the operation of picking.

The trees must never be shaken to cause the limes to fall, for the crop would then be lessened by many flowers and young fruit being thrown down.

The Effects of Long-continued Nitrogenous Manuring.

BY PROFESSOR J. B. HARRISON, M. A., C. M. G., F. I. C.

From the Progress Report on Agricultural Experiments at the Botanic Gardens, 1906–1907.

In 1904-1905 attempts were made by some persons interested in the sugar-industry of the colony but non-resident therein, to explain the marked falling off in the productive power of some of the canefields which has been noticeable of late years by reference to the extraordinary effects of long-continued repeated manurings with sulphate of ammonia which have occurred at the Woburn Experimental Farm of the Royal Agricultural Society and to a less extent on certain of the Experimental Fields at Rothamsted. The soil of the former place is a light sandy one, but the latter is a clay-loam. Where sulphate of ammonia has been used continuously at Woburn for between 20 and 30 years, the soil has been rendered absolutely barren for economic plants, whilst the evil effects of the long continued manuring (for 50 years and over) at Rothamsted with the same salt are now perceptible. Both these Experimental Farms were visited by me in May and June of this year and their results carefully examined.

Advantage was taken in 1905 of the mode in which the experiments have been conducted on the Northern part of South Field to arrange trial-fields for examining into the question whether the use of sulphate of ammonia from 1892 to 1905 had been injurious to the soil of the experimental field and whether better results, would not be obtained by the substitution, as recommended by the non-resident authorities, of nitrate of soda for sulphate of ammonia.

The previous manuring of the field allowed the following comparisons to be made with three varieties of canes on not-limed and on limed land :—

Sulphate of Ammonia after Sulphate of Ammonia (14 years.)
Sulphate of Ammonia after Nitrate of Soda „
Nitrate of Soda after Sulphate of Ammonia „
Nitrate of Soda after Nitrate of Soda „

The following were the mean results in tons of canes per acre:—

	Not Limed.	Limed.	Mean not-Limed and Limed.
No Nitrogen	10·1	12·9	11·5
Sulphate of ammonia after			
Sulphate of ammonia	22·2	24·7	23·5
Nitrate of soda (continuously)	19·3	19·1	19·2
Nitrate of soda after			
Sulphate of ammonia	20·4	20·9	20·7
Nitrate of soda (continuously)	18·7	19·1	18·9

The results of the experiments show that the substitution of nitrate of soda for sulphate of ammonia on the not-limed land continuously manured with the latter has been attended by a reduction of the increased yield, due to the nitrogenous dressing, from 12·1 tons to 10·3 tons, whilst the substitution of sulphate of ammonia for nitrate of soda on the nitrate fields has increased the yield from 8·6 tons to 9·2 tons.

On the limed land, the substitution of nitrate of soda for sulphate of ammonia has reduced the yields due to nitrogenous manuring from 11·8 tons to 8 tons per acre, whilst the change from nitrate of soda to sulphate of ammonia on the nitrate fields practically has not affected the yield.

The apparent ill effects of long-continued nitrogenous manurings are far more noticeable where nitrate of soda has been continuously used than where sulphate of ammonia has been, thus the mean increase on the fields long-manured with the former was 7·5 tons of canes per acre as against 10·6 tons where the latter had been similarly applied. On the not-limed land the increases were at the rates of 8·9 and 11·2 tons, respectively, whilst on the limed land they were only at the rates of 6·2 and 9·9 tons.

These are the results of only one series of experiments and hence require confirmation, but in my opinion they clearly indicate that on very heavy clay-soils, such as that of the Experimental Field, and under tropical meteorological conditions, the de-flocculation or puddling caused by long-continued dressings of nitrate of soda is likely to prove more injurious to the soil than is the souring-action of sulphate of ammonia. The results also suggest that the injurious effects of the nitrate of soda are more marked on limed land than on not-limed land, and, as it is known that the de-flocculation caused by nitrate of soda is due to alkali set free from it in the soil, this is in accordance with what would be expected.

It must be borne in mind that these plots have been continuously manured with sulphate of ammonia or with nitrate of soda for fourteen years only, that the nitrogenous manurings, although high, have not been at all excessive (60 lbs. of nitrogen equivalent to 2¾ cwts. of sulphate of ammonia per acre per annum) and that the alternation of the manures has only extended over one crop. Where soils, especially on the lighter lands of the colony, have been manured continuously for from thirty to fifty years with sulphate of ammonia its souring-action may have become marked and decreases in the yields resulted therefrom. This point is worthy of consideration and investigation by the planters of the colony. The souring is easily ascertained by analysis, the cure for it lies in the application of lime and not solely in changing the use of sulphate of ammonia to one of nitrate of soda.

The Possibility of a Local Fruit Industry.

During the past few years exhibitions of colonial fruits have been held in London on purpose to introduce these to the general public who have no opportunity of seeing them in their native habitats. As a rule, however, tropical fruits do not travel well, so that really good specimens cannot be exhibited. Preserves of some of these have also been exhibited and have been much appreciated; but the difficulty of obtaining a constant supply prevents a market being found. Any industry whatever is of very little use unless the product can be placed on the market in appreciable quantity and the supply kept up.

In each fruit season, in this colony at least, enormous quantities of fruit are wasted; it does not pay to bring a large quantity to market in its ripe state as much gets damaged in transit beyond hope of sale, so it is allowed to rot on the ground. This is the case year after year, thousands of pounds of fruit are wasted which, in many instances, costs nothing to grow, and in others costs little.

A goodly number of well-to-do people are now engaged planting Rubber and Limes; these in a few years are supposed to become paying industries, expenses are being incurred in this hope, but as the experiments are in their infancy nothing is sure about them. Yet in our midst fruits are wasting which could, with a little expenditure in the preparation for their preservation, be turned into a paying industry, and be placed on the market in large quantities for home consumption and for export.

In Europe such waste does not occur because the fruits grown there are converted into jam and jelly, many large and notable firms supplying the world with these commodities. Here we have nothing of the kind, yet fruit is plentiful, and with a little enterprise could be placed on the market as easily as the imported kinds.

At our local exhibitions prizes are always offered for jams and jellies, with a view of showing what can be done in this direction; yet, what do we find,—a few sets of 3 or 6 bottles, as the case may be, some good, some indifferent, others badly put up, but made by persons who could not possibly do more, the exhibits being made expressly for the particular exhibition, only with the idea of obtaining a prize and with no intention whatever of securing orders for a further supply, so that if a quantity of either exhibit were needed a month later none could be obtained,

Take Guava jelly for an instance: there is a great demand for good jelly, and yet, except in the guava season, none can be obtained; often there comes a request for a dozen bottles to send by the Mail to a friend in England which can rarely be met, and then only by some provident housewife actually depleting her own store.

The list of the fruits grown here is a sufficiently good one to warrant their being utilized in this way, and put on the market; some actually growing in a wild state and others requiring little cultivation. Mango, Guava, Gooseberry, Hog-plum, of the first category, and Carambola, Jamoon, Cherry, Governor-plum, Seville Orange and Sorrel, of those needing little care, which could be extended indefinitely.

In the Mango season the fruit is a glut in the market, selling, as in this last season, for 20 to 30 for a penny, and yet nothing is done to preserve them. Mango jam is made for present use in private houses, and is a delicious adjunct to the breakfast table. In the Guava season stewed guava is scarcely absent from the table; the jelly is also made to a certain extent, but never in sufficient quantity to store for future use: the fruit is so plentiful that thousands of pounds of jelly could be made and put on the market, both for local consumption and for export. The Gooseberry (Otaheite) makes an unequalled jelly, and the supply of fruit is practically inexhaustible.

The Hog-plum: this is sought after whenever the trees are fruiting and used in its ripe state, often at the expense of a bill for diarrhœa, yet, made into jelly, it would be a boon to the community.

Carambola, an Asiatic fruit, now being largely planted. No one who has partaken of this preserve would trouble about imported ones if it could be obtained. As a dessert fruit it is delightful, but as a jam nothing can equal it.

Jamoon, also an imported fruit of a few years standing. In its season the crop is so heavy that there is a sufficient supply for everyone who cares to buy the delicious jelly made from it.

Cherry (Barbados). Jam or jelly made from this is exceedingly good, also that of the Governor-plum (more commonly known as Sidium Cherry), the jelly cannot be surpassed in Europe.

Orange marmalade and orange jelly made from the Seville Orange locally is the finest in the world. In their season these oranges are plentiful and ample for a large output, yet only a little is made by a few private persons for their own use and cannot be bought in any quantity.

Sorrel made from the ripe calyces of an annual Hibiscus, both red and white forms,—usually found in the form of a refreshing drink at the fruiting season only, and used within a week or two,—is delicious either as jam or jelly, and as the latter, is equal to Red-Currant jelly. This could be obtained in great quantity with little cultivation.

All these fruits are here and could be used not only for local consumption but for export, and thus be a means of making known the resources of the colony. The need is simply that of a little capital to start the business. As in all industries a capable person must be secured who knows something of jam and jelly making to supervise and teach; there should be little difficulty in finding hands for the greater part of the work, for it would be a means of employing many of the young women and girls for whom there is so little to do, in the same way as is done in Europe. Absolute cleanliness is necessary, for unless the public were well assured of this the articles would not sell.

It is a crying shame that such waste as we see every year is allowed to go on, when for a far less expenditure than that of the industries now being put forward the colony and the home country might be supplied with good wholesome food, not to say luxuries, which cannot possibly be obtained now, so much being allowed to waste.

JNO. F. WABY.

Cooshie Ants.

Ants play a much more important part in the economy of nature in the tropics than in temperate regions. They are by far the most abundant representatives of the insect world and are to be found everywhere, both in our houses as well as out of doors and most articles of food have to be protected from their ravages.

Some of them are of use, acting as scavengers and removing dead animal or vegetable substances which by their decay might vitiate the air. Other kinds again render service by preying upon the scale insects frequently found on plants, which are capable of doing a lot of injury if left undestroyed.

On the other hand, the Cooshie (properly "Acoushi") Ants, also known as Leaf-cutting or Parasol Ants are easily the most dangerous enemies to vegetation in the parts of Tropical America in which they occur.

Their peculiar habit of cutting off fair-sized pieces of leaves of various trees which they carry back to their nests held upright in their jaws is well known to everyone who has lived in this part of the world.

They march along regular tracts, one after the other, and their columns which are often of great length consist of two streams going in opposite directions to each other, the one composed of the ants laden with their booty returning to the nest and the other of ants which have deposited their pieces of leaves in the nest and are now coming back to the trees to obtain more.

They have been observed to go as far as half-a-mile from their nest to attack certain trees although other trees on which they are known to prey are to be found within a much shorter distance.

Not only leaves, but also pieces of flowers, fruits and seeds are also taken back to their nests.

These nests which are usually situated in a spot in the forest clear of large trees, are often of huge size measuring up to 30 feet across, while underground tunnels run from them in different directions for long distances. There are always a number of openings leading into the nest.

For a long time, naturalists were puzzled as to what use was made of the pieces of leaves after they were taken into the nest. By some, the ants were believed to use them directly as food; others imagined that they used them for roofing the underground parts of the nest. In his delightful classic "The Naturalist

in Nicaragua," Thomas Belt, first made the suggestion which has since been verified, that the leaf-cutting ants use these pieces to form beds on which they grow a certain species of mushroom which serves as food for themselves and their young.

Inside the nests these pieces of leaves are cut up very finely and kneaded with their feet and jaws forming a yellowish-brown spongy substance in which no particles of the original leaves can be distinguished, on which the fungus is grown. This particular fungus is carefully looked after and cultivated and all other kinds, which we might call 'weeds', are prevented from growing. So carefully and intelligently is this carried out that the ants have been able to produce a new growth in the fungus, as different as many of our cultivated fruits and vegetables are from their original wild forms.

In many cases it has been proved that if the ants are deprived of this special food they die of hunger. Not very long ago it was discovered that each of the female ants—large dark-brown, fat-bodied creatures measuring nearly ¾ inch in length, with two pairs of large brown wings, which may be seen issuing from the nests in large numbers at certain times of the year—carries in a cavity at the back of her mouth a pellet consisting of filaments of this fungus, with which she is able to establish a fresh fungus garden when she starts making a new nest.

Plants Attacked.

The Cooshie ants show a decided preference for certain kinds of plants, such as roses, oranges, coffee, mango, cabbage, avocado pear, etc. Some other plants, amongst which have been noted grasses, Eucalyptus, heliotrope, laurel, pumpkin, limes, sapodilla, star apple, radish, parsley, celery, etc., they leave almost entirely alone.

With regard to rubber trees, the West African Funtumia elastica is much attacked, while so far as I have observed the Castilloa elastica and Hevea brasiliensis, which belong to this part of the world, escape.

As a rule we may say that introduced plants suffer much more than the plants indigenous to the regions where the ants are found. Many of the latter have special adaptations or contrivances for keeping away leaf-cutting ants, amongst which are the provision of special dwelling places in their stems, leaves or thorns, and also food for certain other ants of a warlike disposition, which, while they cause no injury to the plant which harbours them, at the same time they protect its leaves from the

attacks of the Cooshie ants. The subject is of fascinating interest from a Natural History point of view, but is not of sufficient practical importance to be dealt with in this paper.

REMEDIES AGAINST COOSHIE ANTS.

Several methods have been suggested for the destruction of Cooshie ants and have been employed with more or less success.

1. The following account appeared in the "Official Gazette" of Saturday, 30th July, 1904:—

METHODS FOR THE DESTRUCTION OF ACOUSHI (PARASOL) ANTS.

A method of puddling the soil has been used very successfully in the cacao, coffee, and provision fields of Onderneeming School and has completely eradicated the acoushi ants which were doing much injury to the cultivation. The following is a description of it by H. de Rune Barclay, Esq, Superintendent of that institution:—

SYSTEM OF PUDDLING "ACOUSHI ANTS."

The system of puddling Achousi Ants is as follows:—

(1.) When the ants are observed about, trace them to the entrance hole into the ground which leads to the nest.

(2.) Ascertain, if possible, an exit, which may or not be quite close to the entrance.

(3.) Then dig round entrance hole until the nest is found, dig round the nest.

(4.) Then mix some mud with water, which throw into the nest adding water *ad lib*; puddling with the feet until the whole nest and area round it, comes to the consistency of "Pea Soup"—this may have to be done to a depth of three feet and then the ants will be suffocated.

(5.) Repeat this process whenever these pests appear.

It is evident that while this method may prove successful for the eradication of these pests in the lowlying more or less impervious alluvial soils of the colony it is not likely to be successful on light sandy soils, or on the soils of the undulating parts of the interior of the colony and that there may be places on the alluvial soils where from lack of available labour or other causes the method cannot be adopted.

2. In cases where the above method cannot be adopted the use of carbon bisulphide is suggested. The plan to be followed with Cooshie ants is to close all the holes leading to the nest with earth or clay. Then bore two or more holes to a depth of 1 to 2 feet in the centre of the nest and pour 2 oz. of carbon bisulphide down each hole. Close the holes with earth immediately.

The objections to the use of carbon bisulphide are that it is a highly inflammable liquid, it has a very objectionable odour and unpleasant effects result from inhaling the fumes in any quantity. It is somewhat expensive to purchase locally and in fact is often difficult to obtain, its inflammability requiring it to be specially shipped as dangerous goods.

The following three methods were employed by Mr. Belt, whom I have already mentioned, to protect his garden from leaf-cutting ants.

3. A pint of the common brown carbolic acid was mixed with four buckets of water and after stirring the mixture well was poured down their burrows. This method proved very successful for the ants that survived entirely deserted the nest and it was fully a year before his garden was again invaded. He adds " I afterwards found that when much disturbed and many of the ants destroyed, the survivors migrate to a new locality."

Probably a preparation sold locally as " chloro-naphtholeum " might prove more effective than carbolic acid if used of the same strength. Its price is higher than that of crude carbolic acid but from our experience of it in destroying white ants' nests and the nests of red ants on the lawns of the Botanic Gardens, I am of opinion that it is more effective, because its smell is more lasting.

Belt's second and third methods I will give in his own words :—

4. " Don Francisco Velasquez informed me, in 1870, that he had a powder which made the ants mad, so that they bit and destroyed each other. He gave me a little of it, and it proved to be *corrosive sublimate*.* I made several trials of it, and found it most efficacious in turning a large column of the ants. A little of it sprinkled across one of their paths in dry weather, has a most surprising effect. As soon as one of the ants touches the white powder, it commences to run about wildly, and to attack any other ant it comes across. In a couple of hours, round balls of the ants will be found all biting each other; and numerous individuals will be seen bitten completely in

* This is known to Chemists as perchloride of mercury, and is an extremely poisonous substance requiring to be used with caution.—Ed.

two, whilst others have lost some of their legs or antennæ. News of the commotion is carried to the formicarium, and huge fellows, measuring three-quarters of an inch in length, that only come out of the nest during a migration or an attack on the nest or one of the working columns, are seen stalking down with a determined air, as if they would soon right matters. As soon, however, as they have touched the sublimate, all their stateliness leaves them: they rush about; their legs are seized hold of by some of the smaller ants already affected by the poison; and they themselves begin to bite, and in a short time become the centre of fresh balls of rabid ants. The sublimate can only be used effectively in dry weather.

5. "At Colon I found the Americans using coal-tar, which they spread across their paths when any of them led to their gardens. I was also told that the Indians prevent them from ascending young trees by tying thick wisps of grass, with the sharp points downwards, round the stems. The ants cannot pass through the wisp, and do not find out how to surmount it, getting confused amongst the numberless blades, all leading downwards. I mention these different plans of meeting and frustrating the attacks of the ants at some length, as they are one of the greatest scourges of tropical America, and *it has been too readily supposed that their attacks cannot be warded off. I myself was enabled, by using some of the means mentioned above, to cultivate successfully trees and vegetables of which the ants were extremely fond.*"

6. A plan that I have seen successfully adopted on one estate is to dig a fairly deep trench round the nest and let in water. The ants are unable to cross this and obtain their supplies of leaves for maintaining the fungus beds. Obviously this is only practicable where the soil is clay or loam and where water is close at hand.

7. Many insects, but more especially ants, have a great dislike to lime which in the case of the latter is explained by the formic acid from their bodies setting up a certain amount of chemical action when it comes in contact with the lime, which is alkaline in reaction.

In one place, lime-wash applied round the base of the trunks up to a small height has been of use in keeping away Cooshie ants from trees which they formerly attacked.

The Jamaica Sorrel.

(HIBISCUS SABDARIFFA, L.)

The sorrel is too well known as a cultivated plant both in this colony and throughout the West Indies to require an introduction, still considering the ease with which it may be grown and its pleasant acid flavour, which in the forms of jam, jelly and a cooling drink, is so agreeable in the tropics, its cultivation might with advantage be more largely extended.

A recent Farmers' Bulletin (No. 307) of the United States Department of Agriculture, entitled "Roselle: Its Culture and Uses," advocates the cultivation of the plant in the tropical and sub-tropical regions of the United States. The name roselle is believed to be a corruption of the French word "oseille," the equivalent of the English "sorrel."

In this Bulletin no mention is made about there being two varieties of sorrel, the red one alone being described. The white sorrel, in which the stems are green and the ribs on the calyx white, possesses a somewhat better flavour than the other variety.

CULTIVATION.

The sorrel will thrive on almost any soil, except the very poorest. A sandy loam is the most preferable but the plant also grows well on a clayey soil. Stable manure should be used only sparingly and if used should be supplemented by phosphates and potash because an excess of ammonia in the soil tends to produce large plants with few flowers. Land that is subject to inundations should be avoided and the soil must be well drained.

The roots descend to a greater depth than those of many other crops and so the land must be deeply forked and in a clay soil the lumps should be broken up.

The plants can either be raised in boxes or in seeds beds, but where only a comparatively few plants are to be grown a simpler method is to sow a few seeds in the places where the plants are to remain permanently and when the plants come up to take out the weakest leaving the best one to each hole. The distance apart at which to plant depends upon the fertility of the soil ; planting in rows 6 feet apart and 4 feet apart in the rows will give the plants sufficient space to grow.

GATHERING THE FRUIT.

In the sorrel the large, reddish, fleshy calyx surrounding the seed

pod is the part used for food. The average yield of fruit to each plant is quoted as four pounds, which will give two pounds of calyces.

The yield may be largely increased by picking all the full-grown calyces every few days, which will force the plant to send out new flower buds for some time. The young and tender calyces are easier to pick than the older ones and make a jelly which is more transparent and of a lighter red colour.

Uses of the Fruit.

The calyx is used for making jam, jelly, sauce and a cooling drink. To prepare it for use, take the fruit as picked from the tree between the thumb and forefinger of the left hand with the stalk end up; then cut off the stalk with the base of the calyx to where the seed pod is united with the calyx and a slight pressure of the fingers holding the fruit will force out the seed pod, which is inedible.

In Queensland the cultivation of sorrel has increased largely within recent years, the fruit being manufactured into jam. Two large preserving factories utilizing this product were in operation in 1892 and the jam was shipped to Europe in large quantities.

Considering the high price of jam in British Guiana which is partly owing to an import duty of 6cts. per lb., this is one of the many preserves that might well be manufactured locally and yield a substantial profit.

Use of the Plant for Fibre.

In India the sorrel is grown for its fibre which is used in the manufacture of cordage and coarser textile products. For this purpose the crop is cut while in flower, dried, made into bundles and soaked in water for fifteen to twenty days. A strong silky fibre is then washed out of it, known in commerce as roselle hemp, considered by some to be equal to jute.

It is also mentioned that the leaves are sometimes used as a salad and the seeds are fed to cattle and poultry.

Heavy Versus Light Seeds.

The importance of using heavy seed is well established in the case of many crops. In tobacco it has been shown that the best developed and most vigorous plants are always produced from the heavy seeds while the light seeds produced small, irregular and undesirable plants.

Heavy seeds contain a larger amount of nutriment stored up in them than light seeds. Hence when they germinate they insure a vigorous development in the young plants which they produce. The young plants are found to grow more rapidly, to be more resistant to disease and to adverse conditions and when they arrive at the fruiting stage to produce better crops so that too much stress cannot be laid on the importance of selecting and planting the heaviest seeds.

Farmers' Bulletin No. 285 of U. S. Department of Agriculture on "The Advantage of planting Heavy Cotton Seeds" illustrates well the benefits that are obtained by this procedure. The greater part of the Bulletin is taken up with describing machinery and apparatus used for separating the heavier seeds on a commercial scale, which we need not trouble about. But an account is given of the experiments carried out with the separated seeds, which will show well in this particular case the advantages of the separation.

When the seeds were sown a larger percentage of the heavy seeds than of the light seeds grew, and while many of the plants from the light seeds were yellow and unhealthy in appearance those from the heavy seeds appeared to be much stronger and more vigorous.

Tests were carried out to compare the yield of cotton obtained from heavy cotton seeds with that from ordinary unseparated seeds and an acre of each kind was grown on two different farms. The heavy cotton seeds were found to give over 10 per cent. and 8¼ per cent., respectively, more seed cotton than the unseparated cotton seed. The greater part of this increased yield was clear profit as the cost of separation was very small.

The same principle of selecting the best and the heaviest, in other words the largest seeds may be carried out with most other crops with beneficial results. In corn or maize it will usually be found that several of the grains at the bottom and top of the cobs are smaller in size than the rest and often misshapen. It is a mistake to use these smaller grains as seed-corn for plant-

ing purposes, as a fair percentage of these is likely to considerably reduce the yield per acre. They should be carefully separated from the rest before the seed is sown and may be employed for feeding fowls, etc. By sowing only the largest seeds taken from the finest cobs, a careful planter may in a few seasons greatly increase the quality and yield of his corn.

In certain fruits, such as oranges, limes, star-apples, sapodillas, etc., which contain several seeds, it will frequently be noticed that there is a great difference in the size of the seeds taken from one fruit, some of these being much smaller than others. If the seeds are intended for raising plants all those of smaller size should be rejected as they will probably produce plants which are less vigorous, less healthy and less productive than those grown from the larger seeds.

It is scarcely necessary to add that the fruits from which the seeds are selected must themselves be satisfactory as far as regards flavour, quality and size.

To most rules there are some exceptions, thus in choosing coconuts for seed purposes it is not always advisable to take the largest and heaviest, because in the case of very big nuts it often happens that only a few of them are borne at one time on the tree and the size of the nut may be due to a great thickness of husk, while the most valuable part, the kernel, may be small and thin.

The Importance of Manuring Rubber.

By M. Kelway Bamber, M.R.A.C., F.I.C., F.C.S.

(From "The Tropical Agriculturalist," November, 1907, p. 319.)

Comparing the analyses of a large number of soils from the F. M. S., Java, Sumatra, Borneo, India and Ceylon, where rubber is growing freely, and often luxuriantly, the conclusion is come to that physical conditions of the soils are of as much importance as the chemical composition, at least as regards the early growth of the rubber tree. Soils in an extremely fine state of division as found in the flats of Selangor, appear to suit Para rubber admirably as the roots can spread through the surface soil in every direction without hindrance or check, and there is no doubt this favours the rapid development of both the trunk and branches. But one of the most important results of this fine state of division is the power of such soil to retain a constant but moveable proportion of moisture, which can be brought up by capillarity from the subsoil, as fast as evaporation takes place from the surface: and it is a point of the greatest importance to us in Ceylon to try and improve our soil in this respect. We cannot expect to do much in increasing the general fineness of the soil, though cultivation will improve it; but we can do a good deal to increase the hygroscopic character and retentive power for moisture. The only practical method of doing this is by the growth and burial of green crops to increase the soil humus, while possible to do so; for once get the dense shade of rubber over the soil, and there will be no practical means of increasing the humus except by the annual fall of rubber leaves themselves. Many already recognise the importance of green manuring and shading the soil, and large areas are now planted up with dadaps, crotalaria and albizzias, the two latter being the most suitable for the Kelani Valley soil and climate. Personally I prefer the former of the two as giving a more immediate return of bulky material, which when pulled and mulched on the surface round the trees, could not be beaten in its power of retaining moisture and keeping the roots cool and protected from the direct rays of the sun.

Para is essentially a forest tree in its natural habitat, and its roots would be almost always more or less shaded. Although it is impossible to make any defining statement on the point at present, there is little doubt in my mind that to be able to maintain a constant proportion of moisture in the soil, year by year, will be of the greatest importance both for tapping, and the annual formation of new bark well supplied with laticiferous tubes. A

fairly constant root pressure seems to be essential for a free flow of latex, and if the trees have to send their rootlets far afield to obtain it, in competition with the surrounding trees, a maximum root pressure can hardly be obtained.

I would, therefore, strongly urge the planting of green crops and incorporating organic matter with the soil while there is still a chance of doing it ; as, when once the shade of the trees becomes too dense, no green manure plants will grow.

Another point of importance with regard to the growth of these plants is the necessity of keeping newly cleared soil more or less protected from the direct rays of the sun, as otherwise the loss of organic matter, and consequently the power to retain moisture is extremely rapid. When dadaps or albizzias are planted, as is now generally the case, the mistake is made in letting them get too large before pollarding. They should be cut across at about four or five feet when ten to twelve feet high and mulched in a gradually increasing radius round the young rubber plants By pruning at this height the root development of leguminous trees are checked, and at the same time the cost of pruning is considerably diminished.

With regard to the actual manuring of rubber, we have no practical figures to date, but it is evident that a mixture should not contain too high a percentage of nitrogen, or it will produce a leafy top liable to be broken off by wind. I have here analyses of the best rubber soils, but do not know if it would interest the gentlemen present to see them ; but the chief point of difference lies in the proportion of lime and nitrogen, the potash and phosphoric acid being in the Malaya soils very similar to our own. With regard to lime, this is usually in the best soils three or four times as much as in the average Ceylon rubber soils, and it would be advisable to add this as much as in the average Ceylon rubber soils, and it would be advisable to add this constituent to our soils in larger quantities than we usually do for tea. I am starting some experiments in the manuring of rubber, and have some mixtures based on the analysis of the ash of rubber and of average Ceylon soils which I should be glad to give anyone who would care to try them, as the more data we can obtain the better.

With regard to the application of manure, the statement that root growth is only about one foot per annum is not borne out by my experience either in Ceylon, or the Straits or Java, where in many instances the growth is more like one foot per month than one foot per annum. This point is of importance in applying manure to rubber, for it would be a great mistake to cut the

roots of the rubber through at one foot for each year of growth to apply the manure; as there was evidence in one district I visited, to show that the broken roots allowed the ingress of white ants to the trees.

In my opinion, any manures should be broadcasted all over the soil and lightly stirred into the soil with forks in a gradually increasing ring, which ring should as far as possible be mulched annually with the loppings from shade trees with crotalaria. In many instances in travelling through the rubber districts, one is struck with the unevenness of the growth of the trees, especially when planted in tea, and I would suggest that all backward trees should receive an application of manure on the lines mentioned, to try and obtain uniformity, otherwise when the time for tapping arrives the barks will probably be of different thicknesses, and far more liable to injury by the tapping cooly.

Selection, Milking and Care of Dairy Cattle.

A plainly worded and instructive leaflet, No. 187, "The Selection and Milking of Dairy Cattle," has recently been issued by the Board of Agriculture and Fisheries, London, from which the following notes are taken :

Suitable Breeds.

While there are cows which will yield eight hundred to a thousand or more gallons of milk a year, the writer of the leaflet considers that in all probability the average quantity of milk yielded per cow throughout the country would amount to little more than 400 gallons, which quantity is much lower than it should be. It would be interesting to learn how this yield compares with the average for the creole cows of this colony.

Cows yielding larger quantities of milk, cost little, if any more for keep and labour than those yielding small quantities, while the returns obtained are sufficient to make the difference between a substantial profit and a heavy loss. Another point to be taken into consideration in selecting an animal for the dairy is that a cow, after her milking days are finished, should be able to put on flesh and be saleable as beef. The Dairy Shorthorn heads the list of the breeds which are specially suitable when milk-selling is the object, and is also said to be of considerable value afterwards for producing good beef.

Farmers should endeavour to improve the breed of their cattle by obtaining the services of one of the Shorthorn bulls, which the Government have been to some expense and trouble to import for the purpose.

Points of Dairy Cattle.

The special points to be considered in the purchase and judging of dairy cattle are :—

1. *Temperament.*—The cow should be quiet when handled, possess a clean coat, a long neck, with eyes prominent and wide apart, and the whole expression showing a gentle and phlegmatic temperament.

2. *Shape of Udder.*—The udder or bag should extend well forward, it should be full, flat underneath and well-rounded behind, showing great capacity and each quarter being sound. The teats should be equal distances apart, easy to draw and of a useful size for milking.

3. *General Appearance denoting Milk.*—Some of the characters mentioned are a capacious belly, the flank clean and thin being lean rather than fat, a thin back showing strong spinal processes and a well-set, long and tapering tail with plenty of switch. Looked at from above the animal should appear somewhat wedge-shaped, the shoulders being narrow with the lines spreading out to the hips which should be wide apart.

4. *Indications as to Quantity of Milk yielded.*—The milk veins should be large, prominent and branched, and the milk "wells," where the blood-vessels enter the belly, highly developed.

5. *Points indicating Quality and Colour of Milk.*—Ears which are fine, well fringed with hair and of a deep yellow colour inside are usually certain indications of good quality and colour of milk and butter.

Cows which are heavy milkers are frequently thin and bony, but the buyer should not refuse a cow solely because of her "poor" appearance, cases being known in which such animals have yielded upwards of 1,000 gallons of milk a year.

MILKING.

Cleanliness.—This is one of the most important items in connection with all dairy work. Every cow should be kept well groomed, and the udder and off flank especially carefully rubbed over with a sponge or rough damp cloth before milking is commenced. Milkers should wear clean garments, and wash their hands prior to commencing operations.

Clean Milking.—No milk should be left behind at the end of each milking, firstly, because withdrawing all the milk that can be obtained from the udder develops and increases the milking powers; secondly, because the last milk yielded is far richer than any other during the whole time of milking. Failure to withdraw all the milk from the udder at the time of milking is the commonest cause of cows drying off soon.

To obtain the last portions of milk or "stripping" as it is called, the method known as "streak milking" is used, in which the teat is taken between the thumb and fore-finger, or fore-finger and middle finger, then tightly pressed and drawn downwards. It is not advisable to use this method for ordinary milking, on account of its being likely to irritate the teat externally and even sometimes to cause inflammation.

Wet or Dry Milking.—Milking may be performed with either wet or dry hands, in the former case the hands being moistened

by drawing on to them a few streams of milk. The dry method is the more cleanly of the two, and is the one adopted by the best dairymen. Milking with wet hands is an objectionable practice, and is not recommended except in cases where the skin of the teats has become tender.

Essentials of Good Milking.—The essentials of good milking are that it is performed (1) Quietly: that is, in such a way as to cause no discomfort to the cow. (2) Quickly: rapid milking appears to be beneficial in increasing the flow of milk. (3) Thoroughly: the last milk being the richest must always be withdrawn.

Times of Milking.—The usual practice is to milk twice in twenty-four hours, and the more equally the time is divided the more uniform will be the quality of the milk produced. Thus, if milking is done at five o'clock in the morning, the next milking should be done as near five o'clock in the afternoon as possible. This recommendation is often difficult to carry out in practice. Cows like to be fed and milked at regular times. It is cruel to leave cows for too long without milking, their udders get very extended and may cause the animals much pain.

Drying Off.—Some cows will continue to give milk from the birth of one calf until the next is due. Although this continuous production of milk may be profitable to the dairyman, the cow, unless allowed some period of rest between each calf, suffers very much from the strain: poorer calves are likely to be produced, and the milking powers may be injured.

Whilst most cows do not give milk for more than nine months at a time, many good dairy cows only dry off for a month or so previous to calving. It is desirable that a resting period of from six to eight weeks should be allowed to each cow before calving.

The quantity of milk can be reduced by milking less frequently, finally milking once every other day, then every third day, or even less frequently than this, depending upon the condition of the udder, until so little milk is produced that it is unnecessary to milk at all.

Water and Shade for Dairy Cattle.

Some notes on this subject from the last October number of the Quarterly Journal of the Bengal Department of Agriculture, appearing in "The Agricultural News" for 8th February, 1908, are worthy of attention by everyone who keeps cattle.

"As everyone knows, milk contains or should contain about 87 per cent. of water. In addition to the water necessary to the

production of milk in the animal system, there must be sufficient for the ordinary vital processes in the body, therefore a supply of water should be given to an animal producing milk in such quantities as the animal itself wishes to take as drink. An ideal water supply is, of course, a clear running stream, but in default of this a good supply of clear standing water that is not the least stagnant, etc., will suffice.

"Another important matter is that of shade. *Milking cows must have shade*, otherwise their yield of milk will be greatly diminished by reason of the fact that they become too hot in the full glare of the sun's direct light, uncomfortable and restless and do not graze......... Milk cattle should also have salt within reach."

Report on Mangrove Bark from British Guiana.

(From The Bulletin of the Imperial Institute, Vol. V., No. 4, p. 346, 1907.)

BRITISH GUIANA.

A sample of bark derived from Rhizophora Mangle was received from this Colony in May, 1906.

It consisted of thick dark reddish-brown bark which was of dense structure, contained very little fibre and was readily ground to a dark-red powder.

On analysis it gave the following results :—

	Per cent.
Moisture	15·9
Ash	5·5
Tannin	25·0
Extractive matter (non-tannin) ...	6·4

The bark yielded a medium reddish-brown leather of the kind furnished by typical mangrove barks of commerce.

As this mangrove bark contains only 25 per cent. of tannin, it is not rich enough to be worth exporting to Europe, but it would answer well for local use and would probably yield a satisfactory mangrove extract.

Board of Agriculture.

A meeting of the Board of Agriculture was held in the Court of Policy Hall, at 2.30 p.m., on Wednesday, 5th February. His Excellency the Governor presided. The other members present were Professor J. B. Harrison, Hon. B. Howell Jones, Dr. Egan, Rev. F. C. Glasgow, Messrs. F. Fowler, J. Junor, J. Wood Davis, W. M. Payne and A. W. Bartlett.

The following were some of the principal matters considered :—

It was proposed and carried that members of the Board who were absent from three consecutive meetings should vacate their seats except in such cases where leave of absence had been granted.

Professor Harrison reported that the amount received for the memorial to the late Mr. Jenman had reached only $212 00, which would be insufficient to pay the cost of a drinking fountain. His Excellency suggested a clock be placed above the entrance gates. The Director said that the acting Colonial Civil Engineer might be asked to assist the Committee appointed to consider this matter.

Professor Harrison reported that the stall for the sale of Economic Plants in the Stabroek Market had now been carried on for thirteen weeks during which time the sales amounted to $49 43 while the cost of running the stall was $29 91. At first only economic plants had been sold but afterwards some ornamental plants were added together with fruits of the different varieties of grafted mangoes. The Governor had approved of a vote being placed on the estimates to continue this stall.

Dr. Egan spoke about the usefulness of this stall even if it were run at a loss.

An application from the Committee of the Buxton Show asking to be allowed to use an unexpended balance of $8 90 remaining from the grant of $120 00 given by the Board was refused, because it was contrary to the Board's regulations.

The official report on the exhibits at the Buxton Show was laid on the table.

The report on the Farmers' Competitions of the Upper East Coast for 1907, by Messrs. Bartlett, Waby and Beckett, was presented and read.

Professor Harrison said that there was not much improvement in the villages. Certain village farmers were always to the front

and the others who did not think that they had much chance of a prize did not put much energy into their work.

His Excellency suggested sending up an officer of the Department of Science and Agriculture some time before these competitions were to take place to meet the Village Council and explain the objects and working of the competitions to the farmers.

A letter from the Imperial Commissioner of Agriculture to the Governor was read stating that the recent West Indian Agricultural Conference at Barbados had been entirely successful and thanking His Excellency for the assistance which he had given.

Mr. Wood Davis desired that the Board would place on its records their high appreciation of the services which were rendered by the delegates, Hon. B. Howell Jones, Professor Harrison and Mr. T. A. Pope in having so ably discharged the functions imposed upon them.

Mr. Payne seconded and the motion was carried.

Mr. Howell Jones, in responding, suggested that an invitation should be sent to the Imperial Commissioner to hold the next Conference in this Colony. He thought, however, that a year was too short a time between the conferences and that they should not be held more often than once in two years.

His Excellency spoke in favour of Mr. Howell Jones's suggestion which was put to the Board and carried.

The Estimate of the Expenditure of the Department of Science and Agriculture for 1908-1909 was submitted. It included $500 the cost of establishing an Experimental Rubber Station on the Demerara River, concerning which His Excellency spoke a few words of approval

A report by the Director of the Imperial Institute on cotton from British Guiana was laid on the table. Professor Harrison said that the salient points of this report had already been published in the last Progress Report. The Sea Island cotton had proved generally unsatisfactory but the plants of the Metafifi Egyptian cotton grown from selected seeds had shown a great increase in the yields over those grown from the ordinary seeds. The former had given an equivalent of over 500 lbs. of cotton to the acre.

All the varieties of cotton were doing well this year, owing to suitable weather conditions, but had this happened when cotton was first started, it might have induced several cultivators to take up cotton, which would probably have resulted in some heavy losses.

An application for a grant-in-aid for an Agricultural Show in 1908 from the West Bank Farmers' Association was next considered. Professor Harrison said that the Association was a good one but the grant when applied for last year had not been allowed owing to the money matters being unsatisfactory. Mr. Wood Davis said that he put this down to the inability to manage accounts. He thought that this should not be made a barrier to the carrying out of these exhibitions and was in favour of the grant being given.

His Excellency also spoke in favour of the grant being allowed this year if money was available, provided that they were required to adhere strictly to the regulations laid down.

The motion was put to the Board and carried.

Reports on the experimental planting of Sisal Hemp at Tumatumari, Matope and Arakaka were read. The experiments had been going on for nearly four years and the average length reached by the mature leaves during this time was only 1 foot 8 inches. On a plot in the Brick Dam Field planted at a later date, the average length of the leaves of the two middle rows of plants was 4 feet 7½ inches, of the two outer rows 3 feet 6 inches and for all the plants the average was 4 feet 1 inch.

Professor Harrison gave a short account concerning the Rubber Experiments which had been carried on. Of a total of 60,000 Para Rubber seeds which had been imported during last year, and planted at the Botanic Gardens, 81 % had grown which was very satisfactory.

The Experimental Rubber Station in the North West District had been placed in the hands of Mr. Mansfield, Agricultural Instructor, and the reports of the work which had been done were very satisfactory. The task of draining the virgin forest was being carried on and the work was now in full swing. Trees of Sapium and Hevea had been planted and great credit was due to Mr. Mansfield for the way in which he had tackled the difficulties he had found.

Plots of Sapium, Hevea, Castilloa and Funtumia had been planted at the end of the rice-field and were growing under conditions similar to those that they would experience on abandoned coast lands. Rubber trees had also been planted in spaces cleared for them in the Shelter Field.

Live Stock.

The Shorthorn Bull, "Rosebud Champion" was reported to have died of Texas fever by the Government Veterinary Surgeon

who had also written a valuable report on the disease. His Excellency recommended sending this report to the Stock Committee, for their advice as to publishing it. The Director said that the Committee were of opinion that only bulls immune against Texas fever should be imported.

The importation of a bull, two rams and a boar from Canada was reported. Mr. Howell Jones said that he thought pure-bred rams were too delicate to be brought to this colony. He had imported for himself an ordinary ram which had done very well at Pln. Hope.

Dr. Egan was of opinion that half-bred stock would do better here than pedigree animals, and often the Board paid too much for pedigree.

Referring to the Board's annual sale of Live Stock in December last, Professor Harrison said that he proposed to make a special report to His Excellency with regard to the financial results of the sale, which he thought might be of use for the Stock Commitee to make recommendations upon. The net proceeds of the sale amounted to over $900 00.

Selected Contents of Periodicals.

Cacao.

" Pruning Cacao." Bulletin of the Department of Agriculture of Jamaica Vol. v., Parts 6 and 7, p. 139.

" Cacao Pests in Trinidad." Proceedings of the Agricultural Society of Trinidad and Tobago, Vol. 7, Part 10, p. 281, 1907.

Cassava.

" The Industrial Prospects of Cassava Starch." West Indian Bulletin, Vol. viii., No. 3, p. 260.

Ginger.

" Cultivation and Preparation of Jamaica Ginger." West Indian Bulletin, Vol. viii., No. 3, p. 264.

Limes.

" Cultivation of Limes." The Agricultural News, Vol. vi., No. 148, p. 414.

" Limes Crops and Products." The Agricultural News, Vol. vii., No. 149, p. 14.

" Concentrated Lime Juice and Citrate of Lime." The Agricultural News, Vol. vii., No. 151, p. 46.

Pine Apples.

" Pine-Apple Growing in tne West Indies." West Indian Bulletin, Vol. viii., No. 2, p. 151.

Stock.

" Dairying in Jamaica." " West Indian Bulletin, Vol. viii., No. 3, p. 245, 1907.

Miscellaneous.

" Chillies or Capsicums." The Tropical Agriculturalist, Vol. xxix., No. 6, p. 450.

" Pimento Growing in Jamaica." The Agricultural News, Vol. vii., No. 149, p. 5.

" Preservation of Grain from Weevils." Bulletin of the Department of Agriculture of Jamaica, Vol. v., Part 12, p. 231.

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Notes upon Epizoötic Lymphangitis.

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At the request of several influential planters and friends, with much pleasure I am going to endeavour to combine my experiences with that of others on a subject which should prove of great interest to my brother practitioners, planters, and all owners and users of horses and mules at the present time in this colony. The desire is to give a clear and complete account of a disease about which there is at present a lack of English literature. References to the existing literature on the subject have been freely made. I wish to explain that although I have not yet published anything about Epizoötic Lymphangitis, I have nevertheless been collecting all possible information, and have had some considerable experience of the disease during the South African War as a remount officer, and also in England at the Royal Horse Infirmary at Woolwich in 1902. Until quite recently very little had been written about the disease, and even now a good, clear, concise account is not yet to be found in any of our standard text-books; although the disease has been recognised in England amongst army horses returning from South Africa since 1902, in Ireland in 1903, and in London and other centres amongst private animals in 1904. The earliest report on the subject was made by Col. R. Moore in the *Veterinary Record*, 1896, but at this date was confused with Ulcerative Lymphangitis. Articles have appeared in the Veterinary journals at various times by Sir John Macfadyean, Hunting, Holmes, Martin, Brodie Mills, Newsome, Pallin and others. The two latest additions to the literature are by Capt. W. A. Pallin, F.R.C.V.S., F.R.S.E., and Major E. E. Martin, D.V.H., F.R.C.V.S., Lond., who gave a paper

upon the subject before the members of the National Veterinary Association at their meeting held in Dublin on the 16th and 17th of August, 1904.

Nature of the Disease.

Epizoötic Lymphangitis is a virulent inoculable disease, characterized by suppuration of the superficial and subcutaneous lymphatic vessels, due to the presence of a specific organism. The disease is observed almost exclusively in solipeds (horses, mules and donkeys) but it is reported as having been seen affecting cattle in Japan.

History.

The disease has from time immemorial been almost constantly confounded with glanders, farcy and ulcerative lymphangitis, in whatever part of the world it has appeared, and even with the aid of mallein and modern science, veterinary surgeons of nearly every nationality still continue to make the same mistakes. Since about 1820 French veterinarians have recognized the disease under the name of river farcy, a particular kind of farcy characterized by sores or ulcers on the skin, but every attempt to classify the disease always resulted in its being recognized as glanders or farcy of the skin. The question was again raised by French veterinary officers in 1870 who described it as a disease of the lymphatics, but as glanders and farcy co-existed with the disease, they finally concluded that it was identical, and in this respect history has repeated itself over and over again ; in India in 1899, and during the South African campaign where it was confounded with glanders, and large numbers of animals were shot as such. In 1881 Chenier wrote an article explaining definitely the difference between (glanders) farcy and (lymphangitis) farcy, pointing out that the latter disease only affects the lymphatic vessels and is not the same nature as glanders ; and that experimental inoculation of material from animals affected with the disease never produced true glanders. Finally in 1883 Riolta and Micellone proved that there existed a form of farcy in no way connected with glanders farcy, owing to the constant presence in the pus taken from the cords or nodules of a cryptococcus. In Japan the disease was at one time only known to exist in the north-east, but later on it spread to the south-east, and subsequently it spread to nearly all the provinces of Japan ; from 1887–95 they had a total number of 16,497, averaging over 1,000 cases per annum. In India, as already stated, cases were recognized in 1894 and reported in 1896 by Moore under the title of ulcerative lymphangitis. It next appears to have been

imported into South Africa during the war, and there is not any record of its having been noticed previous to the war; but, seeing how persistently it has been confounded with glanders, it is more than likely that it was there all the time unrecognised: at all events there was every opportunity for its introduction into the country by remounts from all over the world, viz., Southern Europe, America, India, Australia, &c.

BACTERIOLOGY.

The cryptococcus is to be found abundantly in the morbid tissues and products, partly free in the plasma and partly enclosed in pus corpuscles, which are often loaded with from 10 to 30 of them. It is a slightly ovoid body, one end of which is generally rounded and the other pointed. It is known by its clearly defined contour and its very refractile double outline. It measures about 3 to 4 microns in diameter, and in unstained preparations is best seen with an oil immersion lens, and an Abbé condenser under a magnification of not less than 800 to 1,000 diameters, more than ordinary care being taken in regulating the light; in stained specimens the organism can be made out under a much lower power.

STAINING.

This is said by almost every writer on the subject to be difficult, even by Nocard himself, who was I believe the first to stain the cryptococcus. Macfadyean, however, in his Post-Graduate Course, 1905, says the organism appears to stain readily with any of the common bacterial stains, but also appears to part readily with its colour, even to water, unless a mordant is used. The best stain is claudius. Nocard recommends both the Gram-Nicolle and Gram-Weigert-Kuhne methods; in doubtful cases staining is an invaluable aid to diagnosis in a specimen from a suspected wound or abscess.

Below are the various methods with the composition of the re-agents required:—

(1.) *Nicolle's Violet.*

Saturated solution of gentian violet in 90 per cent. alcohol ... ... 10 c.c.
1 per cent. aqueous solution carbolic acid ...100 c.c.

(2.) *Nicolle's Thionine.*

Saturated solution of thionine 90 per cent. alcohol ... ... 10 c.c.
1 per cent. aqueous solution of carbolic acid...100 c.c.

(3.) *Solution for Gram-Weigert-Kuhne's method.*

Concentrated solution of crystal violet ...	1 part.
Distilled water, to which a few drops of hydrochloric acid have been added	10 parts.

(4.) *Gram's Iodine solution.*

Iodine...	1 part.
Iodide of potassium	2 parts.
Distilled water	300 parts.

(5.) *Kuhne's Iodine solution.*

Iodine...	2 parts.
Iodide of potassium	4 parts.
Distilled water	100 parts.

(6.) *Zeihl's solution (carbol fuchsin).*

Fuchsin	1 gramme.
Absolute alcohol	10 c.c.
5 per cent. aqueous solution of carbolic acid...	100 c.c.

(7.) *Counter stain.*

Saturated solution of vesuvine (Bismarck brown).

(8.) *Decolourizing agents*—Alcohol or aniline oil.

(9.) *Clarifying agents*—Zylol or clove oil.

(10.) *Mounting agents*—Canada balsam or Farrant's solution.

Gram-Nicolle's method—Make a thin smear of pus from the suspected wound, ulcer or pustule, on a cover glass or slide, fix it in the ordinary manner by passing it three times through the flame, and then proceed to stain with either No. 1 or No. 2 solution leaving it on for about five minutes; then run it off, removing the superfluous stain by waving it for a moment or two in water, and put on No. 4 solution, which fixes the stain in the organism. After leaving this on for about two or three minutes, run it off and treat with alcohol, which takes the stain out of everything except the various organisms which have taken it up; in fact it will begin to remove it from the cryptococci also if left on for more than a few seconds. Having now decolourized put on the No. 7 solution (the counter stain) and after having left this on for about three minutes run it off, wash in water and dry. The specimen is now ready for mounting in Canada balsam, and can be examined under the microscope.

Gram-Weigert-Kuhne method—(1) Stain with No. 3 solution for five to fifteen minutes. (2) Wash in water. (3) Dry with blotting paper. (4) Treat with No. 5 iodine solution for one or two

minutes. (5) Dry with blotting paper. (6) Decolourize with aniline oil carefully. (7.) Treat with zylol, and mount in Canada balsam. Sections may be stained by this method, but they first require staining for half-an-hour with lithium carmine solution (carmine 2·5 to 100 parts of saturated solution of lithium carbonate). Differentiate in alcohol or acid hydrochloric alcohol, then wash in water and proceed as before.

Claudius method.—Stain with a one per cent. aqueous solution of methyl violet for two minutes, wash and place in a half saturated solution of picric acid for one or two minutes. Decolourize with chloroform or clove oil, then treat with zylol and mount in Canada balsam.

In staining this organism the iodine solution may, with great advantage, be made stronger for the Gram-Nicolle method, viz. :—

Iodine	...	1 part.
Iodide of potassium	...	2 parts.
Distilled water	...	200 parts.

When specimens are treated with alcohol they are much inclined to fade, so that if one wishes to preserve them the methods in which alcohol is used are not to be recommended, therefore it will be easily understood that better results are obtainable where a strong mordant is used with aniline oil as a decolourizing agent; in any case it will be noticed that there are invariably a certain number of organisms in the field which have not taken up the stain at all, and others which are only partially stained. The fact that the organism in a stained specimen can be seen in all three conditions in the one field has been claimed to be an advantage rather than a disadvantage, as some writers on the subject might lead one to suppose. While on the subject of staining, I might mention that all the stains required can now be obtained ready-made in the tabloid form, together with detailed instructions for their use.

The organism is reproduced by budding. The cells become elongated, and after about a week they become dilated, the centre granule enlarges and divides into two or more daughter granules of a faintly yellowish colour and homogenous quality.

Culture, Artificially.

This is obtained with great difficulty. The growth is always slow, and develops much better in an acid than alkaline medium, the temperature not having any marked effect. Tokishige states that he grows it easily. Professor Macfadyean has not yet been able to do so.

Incubative Period.

My experience is that this may be put down as anything varying from three weeks to six, eight or ten months and even more; in fact Pallin records a case which had an incubative period of over thirteen months. I have also a few cases on record in which the disease recurred after being apparently cured, but in none of these did the second incubative period exceed six weeks; still there is not the least difference why the incubative period for recurrent cases should differ very much from those of the ordinary type. Crawford, writing from India, records a case which recurred after fourteen months (*Veterinary Journal*, June 4, 1904).

In experimental cases the first symptoms of the disease appeared after thirty-two days (viz., a nodule) with pustules bursting on the fifty-third day; inoculation being subcutaneous. Mettam in Ireland, experimenting on the disease in 1904, reports that he did not get the nodular symptons until after forty days; that pustules formed and burst five days afterwards, and that the lesions had all healed again and disappeared in fourteen days after the pustules burst, but that three months after the nodules were again putting in an appearance. The mode of inoculation in this case was scarification made in two separate places, one on the near side of the neck which took, and another on the off quarter which did not give any reaction.

Symptoms.

These are usually found upon any of the cutaneous portions of the body, and occasionally are found upon the mucous membranes or may even extend to some of the internal organs. Personally I have seen the disease in the following regions:—

Head.—Eyes (conjunctiva), muzzle, nose, cheeks, lips, submaxillary space, orbital process and inside the external ear.

Neck.—Various portions from head to the trunk.

Trunk.—Withers, shoulders, back, loins, chest, sides, flank, croup, quarters, hips, tail, anus, vulva, perineum, scrotum and sheath.

Fore and Hind Limbs.—At any portion from the horny box or hoof upwards.

Mucous Membranes.—Lining of nostrils, septum nasi, sinuses of the head, pharynx, larynx and trachea.

As will be observed from the remarks already made, the lesions of Epizoötic Lymphangitis can be found upon any portion of

the body, but it appears to be most frequently associated with those portions which are most liable to abrasions from kicks contusions, collar and harness galls: in fact inoculation appears to invariably take place whenever there is a solution of the continuity of the skin, or even a slight abrasion. The disease usually shows itself at the seat of a wound not quite healed, or it may develop from a pre-existing wound; in the latter case, the only thing that is noticed at first is that a small pustule has broken out on the edge of an old scar, or adjacent to it; and cording and knotting of the adjacent lymphatic vessels may also usually be felt so clearly that even from the beginning they may be frequently seen from a distance. But the time required for all these various symptoms to develop varies considerably; sometimes when a limb is the seat of the disease, the whole leg may swell up suddenly as in an ordinary lymphangitis, and no cording or knotting of the lymphatic vessels be recognised until the acute inflammation and diffuse swelling have subsided. Upon another occasion the corded lymphatics may be observed some considerable time before any pustules put in an appearance, and a long chain of nodules are to be seen extending along the course of the lymphatic vessels of the leg, or if found on the head, neck, or any other part of the body they extend to the nearest lymphatic glands.

The nodules vary in size, from a pea to a hen's egg; they are well defined, and at first hard and indurated, but as the complaint runs its course, they soften; the time required for this change is very irregular and depends considerably upon the resistance of the surrounding tissues. Along the course of the affected lymphatic vessels, pustules and abscesses are formed, which burst and discharge a thick yellow pus, stained with blood; the abscesses now continue to discharge, and the cavities become filled up with exuberant granulations, which, protruding beyond the surface of the skin (the edges of which are inclined to become inverted), form bright, red fungoid growth, which bleed easily when touched, and very much resemble farcy buds. Wounds which become infected with the disease may either heal up and then break out again, or they may gradually take on the appearance of the sores just described. The buds, ulcers, or sores, by all of which names they are known, are characterized by their bright red exuberant granulations and their fungoid appearance, as well as by their indurated base and well-defined edges; the adjoining skin, which is partially inverted, has a peculiar shiny appearance; an opening exists in the centre of the bud, from which the pus, at first creamy, afterwards yellowish, oily and curdled, is continually discharging. Careful examination of these buds or sores will show that they are really quite different from

those of glanders (farcy), and that with energetic treatment they have a tendency to heal.

The disease is commonest in the limbs, and will be found in the foreleg, generally extending up along the forearm to the anti-brachial region and point of the shoulder. In the hind limbs it has a great tendency to extend along the inside, also where wounds due particularly to kicks are frequently situated, to the groin, thigh or abdomen I have seen an animal with a large number of nodules of varying size upon one limb, some as small as a pea and others as large as a florin. Numerous cases of contagion after castration and strangles have been seen. Those following castration are most difficult to deal with as schirrus cord is almost nearly certain to follow; and the sheath and scrotum become greatly enlarged and indurated. Those following strangles were also greatly protracted, the submaxillary glands and sub-maxillary space became the seat of multiple abscesses. After obtaining a cure, numerous chains of cicatrices may remain, sheaths of tendons, and joints may also be affected, causing chronic thickenings and enlargements, and the value of the animals to be greatly depreciated. The lesions on the nasal mucous membrane are first noticed in the form of small papules or pimples which rapidly form into vesicles and burst, forming a well-defined ulcer with a raised edge and dug-out centre. They are at first isolated, but later become confluent, and tend to extend to the cartilage of the septum nasi, causing the mucous membrane to become discoloured and greatly thickened by exuberant granulations, at times forming a kind of polypus, which interferes with the respiration and causes snuffling. In advanced cases the cartilage becomes spongy and the nasal bones necrosed. Enlargement of the submaxillary glands, may but does not necessarily, as is the case in glanders, accompany the nasal symptoms, it is not constant, and frequently does not occur even in advanced cases; however, when it is involved, it is generally moveable and seldom or never fixed to the jaw and knotty as in glanders.

In cases where the conjunctiva is the original seat of the disease, no symptoms are observable externally for several weeks after the disease has begun to develop; but as it spreads towards the edge of the eyelid, a slight watery or purulent discharge may be the first thing detected, on examination of the conjunctiva a pale pink, flat, fungoid granulation will be discovered under one of the eyelids or upon the membrana nictitans—varying in size according to the age of the lesions; as the case develops the granulation spreads, and later the adjacent lymphatic vessels become affected. When the nasal lesions are slight, there is an

absence of discharge from the nose, but as the disease spreads a thin fluid, mucous, muco-purulent or sanious discharge develops, to be a little later accompanied by an unpleasant odour from the breath. Except in those cases where the disease is ushered in by the ordinary symptoms of acute lymphangitis, there are seldom any systemic changes accompanying the disease, at least in its early changes, nor for some considerable time after, hence the danger of its spreading amongst a flock or herd before being observed. The temperature usually remains normal, but in some cases there may be a slight inclination to fever of an intermittent character, which seldom runs above 102°. The appetite is very seldom or never impaired, with the exception of very advanced cases, where the tendency is to become generalized, there is little or no loss of condition; in fact, the disease appears to thrive best on animals in good condition in which the lymphatics are well developed and in good working order. A few cases, however, have developed rapidly, run a very acute course, in which the whole system was affected. This is not, however, the usual course observed.

Post-Mortem Lesions.

The corded and beaded lymphatics observed are simply inflamed lymphatic vessels, with their thickened walls, the internal membrane is congested, and the ducts are blocked with thick clotted lymph mixed with pus, which is followed by the formation of the abscesses, pustules and granulating sores. The affected parts are found to be indurated and thickened by the formation of fibrous tissue resulting from the chronic inflammation set up by the disease. The cartilage covering the bones becomes gelatinous and spongy, and both it and the bone eventually become diseased.

Diagnosis.

The ulcer of Epizoötic Lymphangitis is typical, and is characterized by its exuberant granulations, its bright red colour, its inverted edges, and its thick creamy discharge of pus, in fact the appearances are all quite different from those of glanders, for which it has so often been mistaken, although in old cases they are less characteristic. However, if any doubt exists as to the diagnosis being correct, it is advisable to have recourse to all the available experimental means in order to arrive at an indisputable conclusion.

Examination of the pus gives a certain and immediate diagnosis. The cryptococcus is said to be easily seen without staining with as low a power as 400 to 500 diameters, but personally I

always use an oil immersion lens for observing unstained specimens; the organism is recognized by its size, shape, and highly refractory double outline.

The cryptococci are also easy to find in a scraping of the mucous membrane, but are not so numerous in that situation as in the material from a fresh pustule.

Testing with mallein should in no case give any reaction unless glanders is co-existing.

An inclination to heal will be noticed in some of the pustules and sores, especially if energetic treatment is resorted to.

In dealing with an outbreak every effort must be made to reduce the number of wounds to a minimum.

Differential Diagnosis.

(1.) *Glanders* (*farcy*), as has already been inferred, is the disease with which Epizoötic Lymphangitis is most likely to be confounded, and the latter may be distinguished from glanders by the following reasons:—(i.) Healthy appearance of the animal generally. Emaciation and unthriftiness being only present in very advanced cases in which the disease tends to become generalized. (ii.) Almost invariable absence of fever. (iii.) Unimpaired appetite. (iv.) Characteristic appearance of the ulcers, pustules or sores, which have an inclination to granulate and with treatment heal. (v.) The whitish colour and thick creamy consistency of the pus. (vi.) The benign and curable character of the disease. (vii.) Not giving any reaction to mallein. (viii.) Inconstancy of submaxillary glandular enlargement, even in those cases where the nasal mucous membranes are the seat of the disease, and the fact that even when the submaxillary glands are enlarged they are not necessarily fixed to the jaw—a symptom which is generally accepted to be invariably present in glanders. (ix.) The invariable presence of the cryptococci in the pus and tissues. (x.) Glanders and farcy not supervening after experimental inoculations into donkeys, guinea pigs and other susceptible animals.

(2.) *Ulcerative lymphangitis.*—This is due to a bacillus, and care must be taken not to confound it with the epizoötic form which is due to a cryptococcus.

(3.) *Simple lymphangitis and its sequelæ, viz., suppurative lymphangitis* due to acute inflammation and septic infection, is differentiated from the epizoötic form by the absence of characteristic symptoms and of the cryptococcus, and the presence of

various other organisms, especially staphylococci and streptococcus brevis. This disease is invariably easily amenable to treatment except joints and synovial bursa become involved; but it is advisable to examine specimens of the discharge under the microscope, if the case is at all indolent regarding recovery.

(4.) *Tubercular lymphangitis.*—A correct diagnosis can only be arrived at by the presence of the tubercle bacilli, and the absence of the cryptococcus when specimens are examined microscopically, as the macroscopic appearances are similar.

(5.) *Botryomycosis* is a disease due to the presence of the Botryomycis equi, which gets into the tissues and bring about the formation of numerous subcutaneous fibrous tumours, often seen under the saddle and collar seats. They are easily differentiated by the absence of cording, the fibrous appearance of the nodules, and by the presence of the specific organism, which is easily stained with Loeffler's methyl blue.

(6.) *The following diseases* might be confounded with Epizoötic Lymphangitis:—Strangles, variola equina, stomatitis contagiosa pustulosa, actinomycosis, melanosis, urticaria and acne contagiosa. These diseases are all easily recognised by their own characteristics, together with their own particular organism, if due to such and the absence of the symptoms of the disease Epizoötic Lymphangitis, and the non-appearance of the cryptococcus when examined microscopically.

Predisposing Causes.

Upon this point there is considerable difference of opinion. The Japanese state that the most cases occur in animals between the age of 3 and 4 years, and that it prevails more in low, marshy districts than in mountainous localities, more in rainy seasons than in dry, more in cold than in hot weather, but this latter can be accounted for by the fact that the Japanese animals are crowded into stables during the winter; which naturally brings about more wounds and contusions, and the channels for infection are thereby more numerous. Lingard goes as far as to say that the disease cannot exist in cold countries, and recommends it as a method of accelerating a cure. Head, writing in the *Veterinary Record*, states that he had over 100 patients at one time suffering with the disease in South Africa, and mentions that a change to a high district helps the case. My own experience both in South Africa and in England is that climates, districts, nor seasons have themselves practically nothing to do with the spread and development of the disease.

Ordinary Methods of Infection.

The infection may be carried by or on anything, viz., vehicles, soil, fences, dust, gates, stables, harness, horse clothing, grooming and stable utensils, litter, fodder, parasites, flies, etc.; by persons attending animals affected on their hands, clothes, or on sponges, tow, cotton wool, bandages, bottles and other pharmacy utensils, twitches, instruments, etc. A few cases may infect themselves by contact, or what is commoner, they may infect themselves in one or more places additional to that of the original seat of the disease, more especially on the lips or mucous membrane of the nose and eyes—by rubbing and biting, and in these cases it is generally accidental, in their attempts to remove flies from a wound on themselves which is already the seat of the disease. Cases affecting the conjunctiva, with no external symptom, save a slight discharge which passes unnoticed for days, weeks and even months, are most prolific in spreading the disease, particularly in India where native attendants go from animal to animal with a dirty-looking little cloth wiping the horses' eyes and noses and infecting them as they go along; in fact, Pallin attributed the spread of the disease, in one outbreak, to this same cause. As infection only takes place by inoculation of wounds and abrasions, transmission is facilitated by the herding and cohabitating of animals, and this explains why the disease is especially associated with army horses and mules, more particularly in remount depots and large companies. Anything that retards healing of the wounds, predisposes to the spread of the disease, and this fact no doubt accounts for the disease being more prevalent in warm climates, where flies are very numerous, and where the healing of wounds is protracted by exuberant granulations. Therefore, the removal of animals to an elevation has the advantage of removing those difficulties in combating the disease.

Treatments

Are of two kinds, external and internal: the great secret of success is, however, an early diagnosis and a thorough understanding of the disease. Destruction of the virus is the first object to be obtained, and this having been accomplished, the parts recently affected will rapidly heal.

External Treatment—In slight cases, complete extirpation of the tissues invaded, followed by the application of the actual cautery and antiseptic dressing, is generally to be recommended and considered practical, although in a good number of cases very good results have been obtained without those drastic surgical methods, which are, however, particularly recommended

by the French veterinary surgeons. The risk of re-infection during operation and the blemishes which remain are the great drawbacks to this treatment, so that I am inclined to suggest the simpler treatment adopted by Major Newsome and myself at Woolwich, of carefully lancing each pustle when ripe, and using the hot iron in the form of small budding irons together with internal treatment, in preference to extensive surgical methods. Once cording of the lymphatics have developed, the case is much more difficult to deal with. If, however, the cording is localized and well defined, it is possible to have recourse to complete extirpation ; the *modus operandi* is as follows :—Cut down upon the lymphatic vessel, and divide with the actual cautery a few inches above the termination of the cording ; the affected portion is then dissected out and completely removed ; after which the operation wound is thoroughly cauterized and treated with antiseptics as in the first case. In cases where there is diffuse swelling and chronic thickening, surgical intervention is much more difficult and less likely to be attended with success. However, beginning from the periphery, all the affected lymphatic cords should be laid open and treated as above described; all abscesses and pustules should be lanced, their cavities then thoroughly scraped out and afterwards treated with the actual cautery and antiseptic dressing.

When operation is decided upon, it must be carried out thoroughly, and under strict asceptic precautions, great care being necessary to avoid re-infection through the operation wound. I cannot advise the surgical interference to be undertaken upon any of the estates with which I am connected, as the appliances, &c., for proper carrying out of the operation, and subsequent dressing of the large wounds necessarily made, would become only a large source of infection and means of spreading the disease. The cases that were treated by myself surgically at the Royal Horse Infirmary, were carried out with every precaution, and antiseptic treatment adopted in its most rigid form amongst the non-commissioned officers and men who were in attendance solely upon those cases. In spite of these advantages the number of cases cured I do not consider anything like repaid the cost of treatment alone : not counting anything for the services of other veterinary officers and myself who were engaged at the time upon this disease.

Almost every antiseptic and escharotic has been used in the treatment of the disease, and of those generally used, I recommend caustic potash in stick, two drachms to a quart of cold water, or in some cases better results have occurred from the use of corrosive sublimate in strong solutions, not less than

1-250. These solutions to be applied as often as possible to the nodules or sores.

The application of a good strong blister of biniodide of mercury is advised to some cases, as it assists to bring the abscesses and pustules to a head, and thus facilitates treatment.

Great care must be taken that wounds are not being re-infected by flies, dressings, &c.; or that the patient does not bite them, or rub his nose or eyes in them.

Internal Treatment.—In this to my mind there is nothing as efficacious as the compounds of iodine and mercury, both of which seem to have a more or less specific effect on the disease, particularly the mercury when given in conjunction with iodide of potassium in the proper regulated doses.

Mortality.

From statistics obtainable, and according to my experiences the average mortality I consider low, viz., about fifteen per cent.

Prognosis.

Under favourable conditions the prognosis is invariably favourable, provided that the case has not been allowed to run too far before proper treatment is given to the patient. I always consider prognosis as unfavourable when proper means for isolation, and strictly aseptic arrangements for energetic treatment, and an intelligent dependable attendant are not available.

The prognosis of cases in which the nasal mucous membrane, conjunctiva, scrotum, sheath, (after castration), joints or sheaths of tendons are affected, is generally most unfavourable, especially those in which the mucous membranes are the seat of the disease. As it is most difficult to ascertain the extent of the disease, the delicate mucous membranes attached will not stand the severe treatment necessary, and finally it is practically impossible to know for certain when such a case is absolutely cured of the disease. Therefore, very great risk to the well being of the other animals &c., is incurred by keeping such cases under treatment, in fact, unless the most thorough and complete arrangements exist for isolation and treatment, immediate destruction of all verified cases is recommended, particularly where large numbers of animals are being dealt with. Even these stringent measures are not followed by the success anticipated, unless every minute detail of the prophylactic measures are most strictly adhered to and intelligently carried out.

Under the most favourable circumstances, the time required to effect a cure may vary from one month to six months or more according to the extent the disease has developed and the class of case being dealt with.

PROPHYLAXIS.

(1.) In the stamping out of outbreaks and the prevention of this disease, it is imperative that the veterinary surgeon employed should have his orders strictly enforced by those under him, who are in charge of the sick animals. He must be thoroughly acquainted with the appearance of the organism under the microscope, and he will be able to make examination of scrapings and pus from suspicious wounds for himself, so that his diagnosis should be, in every case, quick and absolutely accurate.

(2.) In a unit, shed, or upon an estate, in which the disease has been recognized, daily inspection of every animal should be most carefully conducted, and at these inspections the whole body should be carefully examined, especially those regions which are most exposed to galls, wounds, and contusions. The mucous membranes, and submaxillary glands, should be examined as for glanders, and if there are any symptoms of conjunctivitis or discharge from the eyes, the conjunctiva should be inverted and thoroughly examined; in fact, I always carry out this detail in every case I am examining. All old scars and any subcutaneous enlargements should be carefully noted and watched. The most susceptible regions should be carefully handled for any symptoms of corded lymphatics, and for this a touch acquired by a practical knowledge of the disease is a considerable advantage in diagnosis.

(3.) The attendants in charge of the animals should be instructed in the rudimentary symptoms of the disease, its causes, nature and effects, and they should also be instructed to point out an animal developing swellings, nodules, wounds, or sores, no matter how small or trifling they may appear to be, or from what they may arise.

(4.) The use of sponges, both for grooming, dressing wounds &c., should be discontinued, as also should all the usual wisps and stable rubbers used for wiping eyes and noses of the animals.

(5.) All the animals recognized as effected with the disease should be immediately isolated for treatment, or destroyed as the case may be. All suspicious animals should be isolated separately from the others until such time as may be required to accurately diagnose whether they are free from the disease or not, and then treated accordingly.

(6.) In an outbreak, even after recognition of the organism, should glanders be suspected, the animal should at once be tested with mallein, in case both diseases should be co-existing.

(7.) Every effort must be made to reduce the number of wounds, galls, &c., to prevent spread of the disease to a minimum.

(8.) Empirical treatment or playing at horse doctors is not permissable in these cases, as the disease is of a most contagious nature, and should not be attempted by any one except veterinary surgeons, who, with all the training received at college, &c., find the disease making heavy demands upon their skill to successfully combat it.

(9) In the treatment of wounds the strictest asepsis must be observed, a fresh piece of cotton wool should be used for each animal under treatment and afterward immediately disposed of by burning. A little boric acid or preferably iodoform should be dusted on the wounds after the application of one of the lotions before recommended. In dressing the wounds great care must be taken not to infect the mouth of the bottle containing the lotion by placing the cotton wool against it, in order to saturate it with the solution, but a glazed gallipot or some similar vessel should be used for decanting as much solution as may be thought necessary to dress the animal being attended to and the rest thrown away that remain. Anything that assists towards reducing infection is always to be recommended, therefore, cover the wounds with a light covering of clean cotton wool. Disinfectants should be freely used in the stables, which, must, with their surroundings, be kept clean and free from smell; fly papers may be used with considerable advantage if these pests are at all numerous or troublesome.

(10.) Harness and saddlery used on infected cases should be thoroughly disinfected with solution of perchloride of mercury, 1–250, as far as it is practical, or else, if not of any great value, should be burnt with the carcase, litter, grooming tools and horse clothing.

The clothing of attendants dressing the wounds, and attending to the infected animals, should be thoroughly disinfected.

(11.) Disinfection of all the other animals, stables, grooming utensils, etc., is to be undertaken at least once a month during the outbreak upon any estate or other premises where an outbreak has occurred. Should the floor consist of mud or any other permeable material, it is advisable to burn litter over it, and then remove at least six inches from off the surface and renew with

fresh material; the removed portion must be well mixed with quicklime and buried at least six feet deep, where permeation is least likely to take place.

(12.) In a shed, or upon an estate, where an outbreak has occurred, it should be considered an infected area for a not less period than six months from the date upon which the last case was either separated from the healthy stock or discharged cured, when treatment has been undertaken; further, the animals should during this time be kept under veterinary observation.

(13.) If the disease makes its appearance upon an estate where mules have been running out, it is advisable to have all the animals picketed out so that they are not able to kick or bite each other.

(14.) Finally, the free use of the microscope cannot be too forcibly impressed upon those who may have to deal with an outbreak of this disease. Much time and unnecessary isolation of animals is saved by an early diagnosis, such as can only be made with the aid of the microscope. Material from suspicious looking wounds should be periodically examined, and even in cases where nothing has been detected at first, further examination may prove the presence of the organism.

Success in stamping out an outbreak of Epizoötic Lymphangitis is due to four essentials, viz:—

(1.) Facilities for thorough isolation and treatment.

(2.) Previous experience and knowledge of the disease.

(3.) Early diagnosis in every case.

(4.) Thoroughness with which the prophylactic measures are carried out by the attendants, acting under the instructions of the veterinary surgeon in charge of the outbreak.

Notes.

Manufacture of Puncheon Staves from Local Woods.

Reading in a popular article on the Lime Industry in Dominica that the puncheons used for exporting the lime juice are made out of local wood, an inquiry was addressed to the Curator of the Botanic Station at Dominica, asking for information as to what woods were used for this purpose.

In his reply, Mr. J. Jones, the Curator, states that the timbers used for cooperage in Dominica, are "Mangle blanc," "Mangle Rouge," "Pois Doux Marron," and "Bois blanc," while for headings of packages to contain liquids, "Petit Citron" is generally used.

In a list of the "Useful Timber Trees of Dominica," which Mr. Jones enclosed with his letter, unfortunately the scientific names of only three of these trees are given by which it can be ascertained whether they occur also in British Guiana.

Mangle blanc (Moronobea Coccinea), is known locally as "Mani," it grows to a height of 40 to 50 feet, and the trunk attains a diameter of two feet or more. The tree occurs commonly in low-lying and marshy places in the forest. The bark yields a yellow resin which is employed by the Indians mixed with wax from wild bees' nests for fastening the heads on their arrows. The wood is of a yellowish colour, hard and close-grained, and is said to make excellent staves.

Pois Doux Marron (Inga ingoides), bears the local name of "Whykee," and is plentiful in the coast lands, growing usually by the sides of rivers or creeks, but it reaches only a medium size. There are a number of trees growing along the banks of the Lamaha canal, at the back of the Botanic Gardens. The seeds are surrounded by a sweet white pulp of which children are fond.

The wood is used for staves, and also sawn into boards and planks for indoor work only.

Petit Citron (Ilex cuneifolia), is not known to occur in this colony. Of "Mangle Rouge" and "Bois blanc," the botanical names are unknown. So I cannot say whether these trees are found in the colony. It was the knowledge of the high prices that have to be paid for the white oak staves used in making rum puncheons that caused me to seek for this information. In addition to the above, there must surely be certain of our local timbers which would serve for making puncheon staves and

could probably be obtained at a smaller cost than those imported, besides assisting the local timber industry.

During the year 1906-1907, the number of white oak staves imported into British Guiana from the United States of America was 690,140, valued at $79,128.

Wild Nutmeg or "Dalli."

The following note on one of the species of wild nutmeg (Myristica surinamensis, Roland) occurring in British Guiana, better known as "Dalli," appeared in "The Agricultural Ledger," No. 3, of 1907. "This species is abundant in the West Indies. The seeds are about the size of a small marble and are called *Cuango* nuts by the Spaniards. They have been imported into England in considerable quantity; their first appearance being in Liverpool in 1881 when they were offered as an oil seed. They have also been imported into Germany as a source of oil."

An analysis was made of them by Professor Voelcker, who found that they contained as much as 60·53 per cent. of fat. "The fat is solid at ordinary temperatures, having an agreeable taste and little, if any, odour. It is readily extracted from the nuts by hot pressing or by solvents. When fairly pure it somewhat resembles cocoa butter. The fat was examined by Reimer and Will in 1885. The shells weigh 16 per cent. of the seed. The kernels give to hot ether 73 per cent. of fat melting at 45°. Alcohol leaves 6·6 per cent. of a yellow insoluble substance, and the fat contains 6·5 per cent. of a free myristic acid. The fat consists of pure myristin and a caoutchouc-like resinous substance."

Reference is made to another species also found in the colony and of which we have specimens in the Herbarium, viz., Myristica sebifera, Sw., as follows :—"The tree is a native of Brazil, British Guiana and Cayenne. The oval seeds are about the same size as those of *M. canarica*. The seeds boiled with water yield about 26 per cent. of fat which is made into candles. This fat has been exported to some parts of Europe in the form of bricks, in considerable quantity, but is known only to a few manufacturers. It is used in soap-making, and candles made with it burn with an agreeable aromatic odour."

Of the two species the "Dalli" is the commoner and is fairly plentiful in certain parts of the forest and there are several trees springing up about the grounds of Onderneeming school. The habit of the tree with two opposite rows of leaves, which have

very straight sides, borne along the stems and branches is very characteristic and enables the tree when once known to be easily recognised at a glance. The round fruits measure about an inch in diameter and when ripe, split into two halves, and the seeds fall to the ground. These are about the size of marbles, dark brown and shiny and are invested by a bright-red mace. The tree was bearing fruit in March.

The extracts quoted above show that the seeds are capable of yielding a fat of considerable value to soap and candle-makers and hence in places where they can be obtained in sufficient quantity represent a forest product which is worth collecting and exporting.

PLANTING SWEET POTATOES.

In Volume I. of the Proceedings of the Cuban Horticultural Society, Mr. E. W. Halstead makes a few remarks on Sweet Potatoes, in the course of which he points out the bad results which have been found to follow on the method usually pursued of growing crop after crop from vine cuttings alone, by which means the crops become considerably diminished.

He writes as follows:—"Planting sweet potatoes from vine cuttings while a very necessary and economical method of propagation, is not a natural one, and vine cuttings planted year after year without a return to the tuber gradually lose their ability to produce large crops of tubers. This has been clearly demonstrated in tests conducted by me for the past two seasons at the Experimental station at Santiago de las Vegas. Plots of the same size and side by side were planted and given identical culture, all conditions being as nearly equal as possible. One plot was, in each case, planted with vine cuttings that had been propagated in that way for five known and probably many more unknown generations. The other plots were planted with slips grown from the potatoes themselves. The same variety of potatoes was planted in all plots. When dug, the plots planted with slips yielded four and one-half times as much as the corresponding plots that had been planted with the vine cuttings. *Surely a gain of 350 per cent. in yield is worth considering in any crop.*"

"When about to plant, the potatoes themselves of the chosen variety should be procured and bedded close together but not touching one another and covered with ashes and fine earth or earth and sand to the depth of one inch, then covered with a straw or grass mulch loosely put on to a depth of three or four inches. The bed should be kept moist, wetting it thoroughly when needed and then leaving until it shows the need of water

again; the drainage should be good also, so the water will not stand in the bed and thus rot the potatoes. In a few weeks the slips will be six to eight inches long and ready to plant in the field, which should be in good tilth and ready to receive them. Where a large acreage is to be planted or it is necessary to economise in seed potatoes, vine cuttings can be made from the vines of these first slips as soon as they are of sufficient length.

This cannot be continued, however—cutting vines from vines—without gradually losing the advantage gained by the return to the potato. Few crops that we plant give such prompt and satisfactory returns as do sweet potatoes when good varieties are selected and proper care taken in their planting and cultivation, and few of our crops receive so little care and so much abuse and still give us returns."

The above advice is of the greatest importance to farmers in British Guiana, where I believe the practice followed is always to grow sweet potatoes from vine cuttings.

Dried Mangoes.

At a meeting of the Farmers' Institute of Hawaii a sample of sun-dried mangoes was exhibited, and all who tasted the fruit pronounced it excellent.

Mr. Harry Roberts who had prepared the sample said that the fruit used was that of the ordinary mango, and described its preparation as follows:—It was first peeled and then sliced—about five slices being yielded by one fruit. It was then placed upon trays in the sun to dry; care being taken to allow free circulation of air. No sugar was used; after two days the fruit was placed in double paper bags. Mr. Roberts thought that mangoes dried in this way might perhaps be placed on the mainland market to be used in the same way as dried apples. He thought that the trees on his own premises could produce a thousand pounds of dried fruit every year."

This simple method of preserving mangoes would be worth a trial here, especially when there is a glut of the fruit in the market such as occurred at the beginning of the year, so that the prices obtained can hardly have paid the cost of bringing the fruit to the market.

Preservation of Eggs.

A method for the preservation of eggs, which for simplicity can scarcely be rivalled, is quoted in "Nature" for November

28, 1907. This is known as Hanika's method, and "consists in first putting the *clean* eggs into recently boiled water at a temperature of about 110° Fahrenheit for about 10 seconds and then dipping them into boiling water for 10 seconds, after which they are to be immediately put into cold water. By this treatment all organisms are killed and a hard coating is formed between the shell and the "white." The eggs are finally washed with a little strong alcohol, dried and placed in clean dry sawdust. Eggs so treated were found to be in perfect condition after a lapse of nine months."

The eggs to be preserved should be quite clean; if dirty, they should be washed with a little dilute alcohol (50 per cent.) and carefully dried.

Preserving Grain from Weevils.

In an article under the above heading in the Bulletin of the Department of Agriculture for Jamaica, Vol. V., Pt. 12., p. 252., a note appears by Mr. F. W. Cabaniss, Assistant Director of Agriculture, in Burma, which may be of use to those who desire to protect large quantities of corn, rice and other grain from the ravages of the destructive little weevils.

Mr. Cabaniss employs naphthalene powder and suggests an ingenious method of placing it at the bottom of the bin or bulk, or grain. He takes a bamboo about 1½ inches in diameter and long enough to reach from the top to the bottom of the bin. The joints are punched out of the bamboo so as to be able to pass a stick through from one end to the other. The stick should be just large enough to fit the bamboo, but somewhat longer.

Pass the bamboo with the stick in it down through the bulk of grain until it reaches the bottom and then take out the stick and drop into the bamboo about half a teaspoon of naphthalene powder. The bamboo can then be drawn out leaving the naphthalene at the bottom of the grain.

If there is a lot of grain this should be done once to every 10 feet square of the bulk. The application should be repeated every fifteen or twenty days as the powder evaporates.

This will quickly free the grain from weevils, driving out all those that can escape, and killing those that are unable to do so. This treatment does not injure the grain in any way nor

interfere with its growing powers. None of the odour remains after the powder has evaporated, so the grain is not spoilt for food purposes.

The price of naphthalene in England is from 8 cts. to 12 cts. per lb., and it can be purchased locally from most chemists at about double that price. It is usually sold in lumps and requires to be ground to a powder before using.

Coconuts and Coconut Products.

The importance of planting permanent crops is not sufficiently appreciated by the average farmer. He is generally content to devote his whole attention to the growing of ground provisions, which will bring him in a quick return but usually require replanting annually. The disadvantages of these are, first, that when mature they are generally of a perishable nature, and the farmer is obliged to sell them at once however unfavourable may be the state of the market through over-production or other causes. Secondly, a few crops soon exhaust the soil, especially as manure is often difficult to obtain in any quantity, so that in a few years the land becomes so poor that it requires to be thrown out of cultivation or rested for some years to bring it back into a state of fertility. It should be the endeavour of every self-respecting farmer to improve his land instead of impoverishing it, and to so plant it that he can leave it as a valuable property to his children.

The trees that might be planted to make land of some value are coconuts, cocoa, coffee, limes and fruit-trees. Lime trees and coffee, however, do not grow and bear to perfection, except in the lighter soils, and like cocoa they require to be sheltered from strong breezes. Most fruit-trees will thrive on the ordinary stiff soils of the coast lands if they are given good drainage. Coconuts I propose to deal with in this paper.

I may state here, however, to avoid any misconception of my meaning, that I have no intention of advising you to give up growing ground provisions altogether or even to reduce the present production of these. My suggestion is either to plant a part of the land in permanent products or to put these amongst the ground provisions, which can usually be done with very little extra trouble and cost. The ground provisions will always be required for food, and there must be something of this kind to depend upon until your trees come into bearing.

The coast lands of the colony seem to be particularly adapted in many ways for growing coconuts, and most of the trees already planted give fair crops year after year although they are left in a state of the most utter neglect.

Coconut palms will grow and bear successfully only within a certain distance from the sea-coast; they delight in the strongest sea-breezes and in the greatest amount of sunshine obtainable. They will not thrive when shaded by other trees or where the air

is too still or where there is not a sufficient supply of water always available in the soil.

The tree requires good drainage, and will not grow well with its roots in stagnant water.

SELECTION OF NUTS FOR PLANTING.

A careful selection of the nuts to be used in planting is of the very greatest importance, because it is likely to make much difference in the subsequent yield of the trees.

Seed nuts should be selected from healthy trees of strong and robust growth and of middle age which produce good crops of fair-sized nuts with thick kernels (copra.) Very big nuts are not by any means always the best, because sometimes it happens that only a few are borne on the tree at one time and often their large size is due to excessive thickness of husk at the expense of the kernel. Oblong nuts should be avoided. A large orange-red variety known as the "claret" nut, is one of the best kinds in the colony for planting, because it produces large nuts with plenty of copra.

It does not necessarily follow that because a tree growing by itself produces large crops of nuts, these should be used for planting, because the yield may be due to the surrounding conditions. But if one or two trees growing amongst several others under similar conditions are found to produce larger numbers of nuts of the right kind than the rest, it would be well to obtain seed nuts from these for planting.

The nuts must not be picked until they are fully ripe: they should be gathered by hand and lowered from the tree and not thrown down as is usually done.

To many it may seem a waste of time to follow these instructions for choosing nuts for sprouting when almost any ripe coconut will grow if planted in damp ground, but when it is remembered that a coconut palm may be expected to bear until it is at least 50 years old, it is easily seen that it is well to give plenty of attention to the selection of nuts at the beginning.

An increased yield at a moderate estimate of 10 % to 20 % for every tree each year makes a tremendous difference in the amount of the profits, especially if the total of these is calculated at the end of the 50 years.

In Agriculture, perhaps more than in most other undertakings because the returns are seldom immediate, one requires to look

a long way ahead. Mistakes made in the beginning are difficult or impossible to rectify later.

Sprouting the Nuts.

It is generally advisable to sprout the nuts first and to plant them out in the permanent places where they are to go when the young plants are large enough.

It is recommended to keep the nuts for about a month before sowing, the effect of which is said to be that the husk loses some of its moisture and becomes waterproof.

A piece of good land is to be chosen for a nursery, either in or near the field where the coconuts are to be planted, and the soil is to be dug up to a depth of about 18 inches, so that the young roots which are put out can enter it easily. Trenches are then to be dug about six inches deep, and the nuts placed in them on their sides about six inches apart, either quite horizontally, or, better, with the pointed end directed slightly downwards. The great mistake of planting the nuts vertically, as is frequently done, was pointed out in Vol. I., No. 1, p. 11 of this Journal.

Ashes should be placed in the trenches to keep away beetles and other insects, and the spaces betwen the nuts are then filled in with soil, so as to leave about a quarter of the upper part of the nut unburied Over all should be laid about six inches of grass, straw or cane trash. In dry weather the nuts should be watered every two days.

It is advisable to sow half as many nuts again as the number required because a certain number of them will not germinate, and some will produce bad or weakly plants which it will not be desirable to plant out in one's own cultivation.

The nuts are ready to plant out when the shoots have reached a height of about 18 inches which will take from six to eight months' time.

Planting Out.

On good land the trees should never be planted closer than 2½ to 3 roods* apart. The spreading roots of the full-grown trees will occupy all the intervening space at this distance apart, and if planted closer the leaves will cross and interfere with each other.

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* The Rhynland Rood = 12 feet 4 inches. A standard measure of length for land in British Guiana.

In poorer sandy soils only is it safe to plant closer, but not less than two roods apart.

Holes for planting are to be dug about 3 feet wide and 2 feet deep. The soil taken out of the holes is to be thoroughly mixed with some well-rotted manure or leaf-mould and then put back again into the holes and allowed to settle for a few weeks before the plant is put in.

When removing the sprouted nuts from the nursery every care must be taken not to injure the roots, and any that may be broken or injured should be cut off close with a sharp knife before planting. A smaller hole is made in the middle of the prepared hole large enough to contain the sprouted nut with its roots which is placed carefully in the hole and the soil filled in around it so as just to cover the nut. Many planters cut off the ends of all the roots that have formed from the sprouted nuts, as the growth of new ones is supposed to be hastened by doing this.

The writer is of opinion that it is a mistake to bury the nuts deeply in the soil as is advocated in some agricultural works, mostly with reference to lighter soils, because this practice, if followed here, appears to have a retarding effect on the growth of the young palms in our heavy clay soils. One advantage that deep planting is said to possess is that it enables the plant to secure a firm hold of the ground and prevents it from being overturned by a strong wind ; but I have heard of no distance of a coconut palm being blown over in this colony.

The manner of planting followed in Ceylon, where, as a rule, the most scientific methods of agriculture are adopted, is to remove the sprouted nuts when they are about 6 months old from the first nursery to another one where they are planted 3 feet apart and high cultivation is bestowed upon them. They are not transplanted into the positions they will permanently occupy in the cultivation until they are from two and a half to three years of age. All nuts which are slow in sprouting in the first nursery are rejected and not replanted into the second one, and any plants in the second nursery which do not show vigorous growth are also rejected. This method gives opportunity for a very careful selection of only the best plants, and it is claimed that fields planted in this way are most regular and yield the largest number of nuts per acre.

The saving affected by not having to keep the whole field clean for the three years during which the nuts are growing in the nurseries is claimed to more than cover the cost of the nurseries and transplanting the three-year-old plants.

CARE AFTER PLANTING.

In this colony, with very few exceptions, after a nut either sprouted or unsprouted is put into the ground the farmer considers that he has done everything that can be expected of him until the tree comes into bearing, when he will gather the nuts as they become ripe.

This total neglect of everything that can be called cultivation is probably one of the principal causes why there is so much disease at present amongst the coconut palms in the colony.

After planting, the ground for a short distance around each tree should be kept clean by periodical weedings. A careful watch must be kept for the attacks of the large coconut beetle or "cockle" which is sometimes very destructive to young palms. Putting ashes around the plants is said to keep cockles away or a layer of sand has been suggested as a preventive of their attacks. In any case, it is important that the young palms should be examined at frequent and regular intervals. When one of the large tunnels made by the beetle in the soil usually close to the stem of the young plant is observed, the insect must be sought for by digging and destroyed, or it will kill the plant by eating its way up into the centre.

Young coconut palms require plenty of water, and in very dry weather this must be given to them. The Hindoos have a pretty saying referring to young coconut palms, which runs :—

"Water me continually during my youth and I will quench thy thirst abundantly during the whole course of my life."

All of the weeds obtained by weeding around the trees as well as any other grass and bush that can be obtained should be put round the trees to form a mulch, both to preserve the moisture in the soil and when they decay to furnish food for the plant. These must not be piled up close round the stem but spread out so as to form a layer for some distance around the tree. Applications of manure and wood-ashes are also good for the plant.

Care must be taken that the nuts are kept covered with earth because if not deeply planted they are often apt to grow out of the soil in time. When this happens earth should be put round the base of the palm, so as to again cover the roots. Any catch crops such as cassava, sweet potatoes, maize, tannias, etc., may be planted between the trees but not too close to them so as to interfere with the roots and check the growth of the young palms. When the trees reach a fair size I should imagine that their root system is sufficiently strong for the plants to be able to look

after themselves in this respect and that other plants growing too close to them would suffer more than the palms themselves.

It is well known that coconut palms here as well as in the islands are sometimes attacked and killed by certain fungus diseases. A short account of the most important of these, based on a Report by the Mycologist of the Imperial Department of Agriculture, was given in Vol. I., No. 1 of this Journal, and remedies were recommended for getting rid of the diseases.

Prevention is better than cure; and the most important preventative is to endeavour to maintain the trees in a thoroughly healthy condition by attention to drainage, etc. Nuts for planting must be taken only from the most healthy and vigorous growing trees and any weakly plants should not be planted.

In the case of palms killed by some disease it is of the greatest importance to destroy any parts of the dead palm infected with the disease, in order to prevent it from spreading to other palms. Instructions for this are given in the article already referred to.

Coconuts will sometimes begin to bear nuts in small numbers when they are about six years old, but they usually take a few years longer to come into full bearing. They will continue to produce nuts until they are from 60 to 80 years of age.

From inquiries that were made some time back from various coconut planters in the colony, the average number of nuts that may be expected is from eighty to one hundred per tree, per annum. Individual trees were mentioned as giving from one hundred and fifty to two hundred nuts each year.

There is little doubt, considering how favourable the coast lands appear to be for the growth of the coconut palm, that with careful selection of seed nuts and attention to planting and cultivation, the average yield might be considerably increased, probably by half as much again.

Most of the large areas in the colony planted in coconuts receive no attention, beyond picking all the nuts that can be obtained, and are practically left in an abandoned condition. Therefore, the yields reported from them furnish little or no guide as to what should be the returns.

Coconut Products.

The chief value of coconuts is in the oil that they contain. Either the nuts themselves may be exported, or copra, or coconut oil.

At the present time there is a great demand for coconut oil and copra, and the nuts are also obtaining a good price.

Coconut oil obtains a higher price than any of the other oils of its class, being especially suitable for soap and candle-making. The soap manufactured from it is firm and white, and has the property of readily forming a lather with sea-water, which renders it especially valuable for use on board ship.

Preparations of purified coconut oil are employed for edible purposes in England under the names of "vegetable butter," nucoline, etc.

Coconut oil is generally stated to have a great tendency to become rancid, but it has been proved that this deterioration is brought about largely by the moisture and other impurities contained in the impure oil. Pure coconut oil will keep as well if not better than most other vegetable fats and oils.

In the manufacture of oil one very important fact is too frequently overlooked, viz., that the nuts must not be used until they are fully ripe. Experiments, for instance, have shown that the percentage of oil in a fully-grown but still green nut is only about half of that contained when the nut is fully ripe. The percentage of oil goes on increasing in nuts which are stored for three months after they are ripe. So that a considerable loss of oil is incurred in obtaining oil from nuts freshly gathered from the trees or picked before they are ripe.

The shipment also of immature nuts depreciates their value in the markets, and the planters in Trinidad think that the only way to avoid the pickers gathering some unripe nuts with the ripe ones, is to allow the trees to drop their nuts in the natural course. It has already been pointed out that fallen nuts should not be used for seed purposes.

MANUFACTURE OF COPRA.

Copra is the commercial name for the dried kernel of the coconut, which forms one of the principal articles of export from the islands of the South Pacific, and is used for extracting oil from.

The necessity of using only fully ripe nuts which have been kept for some weeks after gathering is as important in the preparation of copra as in the manufacture of coconut oil. Copra made from unripe nuts contains a smaller percentage of oil, takes longer to dry, and turns mouldy more readily.

When storing nuts to make copra or oil it is, of course, essential

to keep them under a shed where they will be protected from rain to prevent them from beginning to germinate.

The first operation is husking the nuts. This is performed by striking them on the sharp end of an iron bar strongly driven into the ground. One man can husk on an average about 1,000 nuts in a day. A new method of removing the husks was mentioned and illustrated by a photograph in the Proceedings of the Agricultural Society of Trinidad and Tobago for April last. The sharpened corner of a mattock or heavy hoe is firmly fixed into a wooden framework, and is said to split the husk much more readily than the pointed iron stake.

The following simple methods of drying copra are employed in the Philippine Islands. The nuts are split in half by two blows from a cutlass, and the two halves are dried by spreading them in the sun face upwards upon large wooden trays, which can be moved at night-time and in case of rain under a shed. Two or three days in the sun are sufficient for the meat to become partially dry and sufficiently shrunken to be easily removed from the shell. They are then put back in the trays and exposed for a few days longer to the sun until thoroughly dry.

Another method in use is to pile the halved coconuts face downwards on a bamboo grating over a slow fire of husks burning in a brick kiln about 6 feet high, the whole inclosed in a large shed. One night's drying is sufficient to remove the shells, and after heating in the same manner for four or five hours on the next day, the copra is ready to store for the market. Grill dried copra is less liable to mould and attacks of insects, but is considered on account of its dark colour and smoky flavour, to be inferior in quality to the sun-dried article.

For drying copra on a large scale, an arrangement similar to that of an ordinary cocoa-drying house is used, and the only manipulation required is to frequently stir and turn over the pieces of copra, so that all parts may be exposed to the drying action of the sun and wind. The length of time required to dry the copra thoroughly, varies from five to ten days, according to the amount of sunshine and atmospheric conditions.

Artificial heat is sometimes a necessity, and in the construction of a house for this purpose, it must be remembered that heat is of only secondary importance, and that ventilation or the means of circulating dry air, and removing the moist air should take the first place. The use of the heat is not to directly heat the copra, but to dry the air, and enable it to take up more moisture than it otherwise would in its passage through the copra.

An artificial drier can be run very economically; all the fuel required being furnished by the husks and shell of the nuts.

With regard to the yield of copra, this depends very much upon the size of the nuts, and the figures quoted for the produce from 1,000 nuts vary so greatly in different countries that it is of little use mentioning them. The most profitable plan appears to be using the small nuts for making copra and selling the large ones.

The advantages of copra are, as just stated, that nuts of inferior size if fully ripe, can be used for its manufacture, which, if exported whole, would obtain a poor price; also, we have a product which will keep for some time, should the state of the market be unfavourable. In addition, the cost of exporting copra, is of course less than that of shipping the nuts.

It is very desirable, that a plant of any kind for manufacturing copra, should be situated either on or in the neighbourhood of the cultivation where the coconuts are grown to avoid the cost of transporting these.

Coconut Oil.

At present the bulk of the coconut oil produced in the colony, which is largely used by East Indians, is made by small producers. There is, I believe, but one plantation furnished with a proper crushing mill for reducing the copra to a fine state of division and an hydraulic press for squeezing out the oil. The small grower employs a rotary grater for grinding the copra, the pieces of which are held against the grater by hand, and after a preliminary boiling, a hand-press is used for removing the oil remaining in the meal. It is unnecessary to add that the oil so produced generally has poor keeping qualities, an inferior extraction is obtained, and the cost of production is high.

In Trinidad, where several of the large coconut estates are equipped with proper appliances, including an hydraulic press, they have been able to pay more for the nuts of the small growers than the latter could realize by turning them into oil by the the old crude method.

In an article on "Coconut oil" by Mr. W. Greig, in "Industrial Trinidad," the writer states that "the cost per gallon of oil extracted does not exceed 10 cents in a small plant capable of an output of 100 gallons per day, including capital and depreciation charges, as well as labour and supplies."

It must not be forgotten that the residual meal left after the oil has been extracted, forms a first class food material for cattle,

swine, sheep and poultry, and will also serve as a partial substitute for oats with working horses. In most plantation oil factories, the value of the residual meal as a stock food, covers the cost of manufacture. Probably the most profitable way to employ it would be to use it for feeding stock on the plantation and to spread the manure from the animals around the roots of the trees.

With regard to the comparative profits to be obtained from the shipment of coconuts, copra, or oil, this will depend on the price for which each is selling at the time. It is recommended that each plantation should have a simple table calculated from its cost of production and results showing the relative values of nuts, copras and oil to serve as a guide in the disposal of its products.

Texas or Red Water Fever.

By JNO. A. RALEIGH, Government Veterinary Surgeon.

(A Report published in "The Official Gazette" of Saturday, 28th March, 1908.)

It has long been an established fact that Texas or Red Water Fever in cattle, known also as Ixodic Anæmia, is caused by the introduction of a piroplasma into the blood stream. This piroplasma is called the piroplasma bovis and is conveyed from animal to animal by several genera of ticks. The parasite is easily recognized in the blood of animals suffering from an acute form of the disease, and is seen as club-shaped organisms, generally in pairs, in the red blood corpuscles. In the chronic form of the disease the parasites take on various shapes, but are generally perceptible as small black discs. The phases of development of the piroplasma are, up to the present, incomplete, although it has been recognized in a great variety of forms both in the blood of the tick and that of cattle. In examining a smear of blood from a suspected case of Texas Fever it is advisable to select the swollen red blood corpuscles in the field and examine them carefully as in these you will generally find the parasites.

In British Guiana, the disease is communicated by a tick belonging to the genus Rhipicephalus and known as the Rhipicephalus annulatus. It may be described as a rounded oblong tick constricted in the middle, with two fissures above the constriction and three below it. It has a short, broad head with two concavities situated immediately behind. Its upper surface is of a peculiar brown colour, and the under slate-coloured. It has no tail, eight rows of teeth, and in the male the scutum extends to the posterior margin.

The method of infection is as follows:—The ticks after being hatched remain in the grass and await an opportunity to climb up the legs of passing cattle. Having got on the cattle, they generally locate themselves on the inside of the thighs, the flanks, and dew-lap—at this stage they are known as seed ticks, and measure about $\frac{1}{32}$ of an inch,—immediately after this they begin blood-sucking, and grow rapidly. At the end of a week they moult, throw off their outer covering, and appear with an additional pair of legs (making eight legs). A week later there is another moult, the tick this time having fully developed sexual organs. At this period the male and female are about the same size, but soon after, fertilization takes place with the result that the female ticks rapidly become swollen. After two or three weeks

they fall to the ground and deposit their eggs which number about two thousand. These eggs hatch in from ten to twenty-one days, and, should the adult tick have been affected with the protozoa of Texas Fever its progeny will be born also infected and convey it to any unimmuned cattle on which they happen to feed.

I have collected hundreds of ticks in the counties of Demerara and Essequebo, but have been unable to do so in the county of Berbice.

In the former counties I found several varieties, amongst them being the Rhipicephalus annulatus, a well-known conveyor of Texas Fever. In the blood of these ticks I recognized various parasitic bodies, which, in my opinion were phases of the Texas Fever parasite. I have only been able to examine the blood of twelve head of suspected cattle, seven of which were from Essequebo and five from Demerara. Out of these twelve specimens, I am satisfied that nine showed conclusive proof of suffering from chronic Texas Fever, and the remaining three were distinctly suspicious. I would mention that the blood was taken from selected animals, the symptoms of which pointed to their suffering from chronic Texas Fever.

Texas Fever is one of the most fatal diseases affecting Northern cattle brought to British Guiana, my experience being that 90 per cent. of cattle imported from Europe and Canada die from it, native cattle having a natural immunity from its ravages, although they often suffer from a chronic type, which is responsible to a great extent for the degenerate and weedy appearance of most of our cattle. As long as we have the tick which is the source of contagion present in our pastures we can abandon all hope of producing really prime stock, and keeping imported cattle alive, unless they are constantly stabled and kept free from ticks.

I have endeavoured to discover how the tick was originally brought to the colony, and, from information gathered, I am satisfied that it was imported when large shipments of South American cattle were brought here.

As the disease is practically incurable, statistics to hand showing 95 per cent. of deaths, our only hope is to adopt prophylactic measures for its eradication, and, although there are many methods, which I am prepared to supply on application, the following I consider the simplest:—

The continual destruction of ticks by fire, viz., that the pastures be burnt at certain times of the year, the cattle regularly ticked, and the ticks that are taken off destroyed by fire, as killing them

by crushing is useless, for the eggs are often not destroyed with the result that they hatch and liberate thousands of larvæ. The cattle should also be changed from pasture to pasture at intervals of about three months, which will be the cause of considerably diminishing the number of these ticks by starvation as they are unable to travel to any appreciable distance and unless they can get their host on which to feed, they die in from two to three months.

As the result of my investigations, I am quite convinced that the ticks play a more important part in diminishing the size of the cattle of this colony than inter-breeding, for it is impossible to expect animals to develop as they should when they are being constantly irritated and blood-sucked by these pests.

In conclusion, I would emphasize the fact that the red water fever affecting the cattle of this colony is not the red murrain of Europe, but the Texas Fever of South America.

JNO. A. RALEIGH,
Government Veterinary Surgeon.

Notices of New Books.

A. B. C. of Lime Cultivation.

This forms No. 52 of the well-known Pamphlet Series of the Imperial Department of Agriculture, and a copy has been kindly forwarded to us by the Imperial Commissioner. Now that increased interest is being taken in the growth, and exportation of limes in the West Indian Islands, and an important Company has started operations in British Guiana for the growing of limes and the manufacture of lime products the appearance of this book is very opportune.

The preface states that the manuscript was prepared by Mr. Joseph Jones, Curator of the Botanic Station at Dominica, and was afterwards carefully revised by the Hon. J. C. Macintyre, an experienced and successful lime planter in Dominica, and by the scientific officers of the the Imperial Department of Agriculture. Thus originating in the island of Dominica, where lime products form the principal exports, and with the additional advantage of being revised by a planter with practical experience, the information contained in the book cannot fail to be both useful and valuable.

In the introduction, the growth of the lime industry is dealt with, and the first part is occupied with clear and concise instructions for cultivation.

Estimates are given for the cost of the buildings, machinery, etc., required for the manufacture of concentrated lime juice.

The second section of the pamphlet is devoted to an account of the various products which may be produced from a lime cultivation. These include green and pickled limes, lime juice, both raw and concentrated, citrate of lime and hand pressed and distilled lime oil. Details are given of the preparation of each of these various products for export, and an alternative method for the manufacture of citrate of lime is described in the first Appendix.

In Appendix III. tables are given showing the exports of lime products from Montserrat and Dominica, the total value of which in 1907 amounted to £7,749 in the former island and £77,407 in the latter.

Appendix IV. is a list of useful references on the subject.

To anyone who is thinking of embarking in the cultivation of limes this pamphlet is almost indispensable, representing to

the best of our knowledge the most complete account that has been written on this subject.

It is published at the low price of 4d., and can be obtained at "The Daily Chronicle" office, the local agents for the sale of the publications of the Imperial Department of Agriculture.

A Rice Cook Book.

At the last meeting of the Board of Agriculture, an account of which is given elsewhere in this issue, reference was made to a small book, entitled, the "Carolina Rice Cook Book," a copy of which had been forwarded to the Board by the Imperial Commissioner of Agriculture for the West Indies.

This is a nicely printed pamphlet, of about 90 pages, containing some hundreds of receipts for various dishes, in all of which, rice plays a more or less important part.

The compiler, Mrs. Samuel G. Stoney, in the introduction, describes Carolina Rice as superior to every other variety in the world. She goes on to say that rice forms the principal food of fifty-four per cent. of the inhabitants of the globe, and that it contains more nutritious matter than other cereals, such as wheat, rye, maize and oats, and even excels in this respect both fat and lean beef. In addition, when boiled, it is more easily digestible than almost any other food, and hence forms a safe diet for invalids.

The receipts are classified under the different headings of Breads (which includes Cakes), Soups, Meat, Fish and Side Dishes, Desserts and Invalid Diet.

In this colony where so much rice of an excellent quality is produced locally, and where the cousumption is also large, this little book is likely to be found useful. It is published at the price of 25 cents by the Carolina Rice Kitchen Association, Charlestown, S.C., U.S.A., and the postage of it will not exceed 2 cents.

Principles of Agriculture by P. M. de Weever.

We have received a copy of a book, with the above title from the writer, Mr. P. M. de Weever, Schoolmaster of the Government Industrial School, Onderneeming. This work, as is stated in the preface, is intended for teachers in the colony, who are taking the examinations in Agricultural Science, and consists of about 90 pages.

Mr. de Weever must have read very diligently and widely, and has evidently expended a considerable amouut of time and trouble

in the preparation of the book. It contains, however, much information that is quite superfluous in an elementary work of this kind, and we notice also many inaccuracies.

In our opinion Part II. which is devoted to the "Outlines of a Course of Elementary Science Teaching adapted to the Study of Agriculture," and which consists of notes for lessons on Nature Study, and suggestions of simple experiments by means of which the facts may be demonstrated, is the best part of the book. Here evidently, Mr. de Weever is treading on ground with which he is familiar.

We are afraid, however, that the price of $2 00 at which the book is published, will place it beyond the reach of most school teachers.

Board of Agriculture.

A meeting of the Board of Agriculture was held in the Court of Policy Hall, at 2.30 p.m., on Wednesday, 22nd April. His Excellency the Governor presided. The other members present were: Professor J. B. Harrison, Hon. Dr. J. E. Godfrey, Hon. C. P. Gaskin, Hon. F. Dias, and Messrs. F. Fowler, J. Brumell, W. M. Payne, J. Wood Davis, J. Junor, J. Monkhouse, B. Gainfort, S. H. Bayley, A. W. Bartlett and Dr. Egan.

The following were some of the principal matters considered :—

The re-appointment of Mr. B. Gainfort and the appointment of Mr. S. H. Bayley as members of the Board, were notified. Mr. Bayley was invited to pay special attention to the agricultural interests of Essequibo, and the Board was asked to sanction payment of the travelling expenses which he incurred in visits made in the district on the Board's business. His Excellency stated that the estimate of expenditure for 1908-1909 had been passed by the Combined Court, including an estimate for the cost of a new experimental rubber station.

A return showing the number of economic plants sold at the Stabroek Market Stall since the beginning of January was submitted to the Board. The list included 296 coffee plants, 133 cacao, 151 mangoes, 78 Hevea braziliensis and various fruit trees. The total number of plants sold was 1,137, and the receipts were $37 51. Hon. F. Dias remarked that the number of plants kept at the Market Stall was small. He said that he had been there when there were only 12 or 15.* His Excellency directed that the plants were to be sent down in larger numbers.

Referring to the Grants-in-aid to Agricultural Shows and Farmers' Competitions during the coming year, Professor Harrison said that the amount voted was $1,340, which he proposed should be divided up in the following manner:— Bagotville Show, $120; Belfield, $150; Berbice County Show, $750; Buxton District Farmers' Competition, $100; School Gardens' Exhibits, $120; and the Board's expenses for Model Exhibits, $100.

Mr. Payne objected to the money being divided up amongst these smaller Shows in which he saw no use. He thought that it would be better to have larger Shows and more substantial prizes.

**Accurate* records show that the number has never fallen below 100.—ED.

His Excellency said that these subsidiary Shows educated the villagers and lead up to the County Shows, one of which was held every year.

The Director said that the prize-takers at the small Shows practically sweep the board at the larger exhibitions.

Mr. Wood Davis and Dr. Egan also spoke in favour of the district Shows, and the latter said that he considered that the county Shows depended upon them for their existence.

The grants as apportioned were passed.

A report by Mr. Waby on the Essequibo County Show was laid on the table. Professor Harrison said that the most satisfactory part of the Show were the School Gardens' exhibits which were a marked feature.

A book, entitled the "Carolina Rice Cook Book," which had been forwarded by the Imperial Commissioner of Agriculture for the West Indies was laid on the table. It was decided to circulate it among the members of the Board.

Reporting on the keeping powers of mangoes Professor Harrison said that Mr. Bartlett had tried experiments with a large number of mangoes, soaking them in 3% formalin for 10 minutes to test their powers of keeping, but the results had been unsatisfactory. The trials had, however, shown that certain varieties of mangoes even when untreated, if carefully picked and unbruised, would keep for several days, long enough for them to be exported to England where they would obtain good prices.

Referring to a letter received from the Caravonica Cotton Growers, London, applying for between 500 and 1,000 acres of land for growing cotton, Professor Harrison said that a reply had been sent pointing out the very reasonable terms on which land can be obtained in the colony. Last year a yield at the rate of 1,358 lbs. of Caravonica cotton had been obtained from experimental plants at the Brickdam field.

In view of the unsatisfactory nature of the sales of the Board of Agriculture Journal, Professor Harrison suggested that the example of the Jamaica Board of Agriculture should be followed, and the Journal supplied free to any resident who forwarded his name and address. His Excellency proposed that the charge should be reduced from 6 cents to 2 cents a number, which it was decided should be done.

Professor Harrison reported that during the year 1907-1908 47,000 Rubber plants had been sold at the Botanic Gardens,

which realised $1,487. The amount of the vote for importing the seed was $720, and the cost of growing the plants was approximately $507, so that $260 had been cleared by the sale of these.

The Director said that circulars had been sent to all the managers of sugar estates, to ascertain their views with regard to the experiments carried on at the Botanic Gardens, and the mode in which the results for some years back had been reported. With two exceptions, the managers in their replies spoke in the highest terms of the utility of the experiments, and they said that they took great care to ensure accuracy in their returns.

His Excellency considered that an abstract of the replies sent in would be very valuable, and might be circulated and published.

Professor Harrison gave an account of the areas under cultivation, with varieties of sugar cane other than Bourbon, during 1908-1909.

When the item "Progress on the Rubber Farm" was reached, His Excellency invited Mr. Fowler, who had lately visited the farm, to express an opinion as to its progress.

Mr. Fowler said that he thought great progress had been made, and the cultivation looked very flourishing. Mr. Mansfield had empoldered about eight or ten acres, and put up a nice house and a range for the labourers. He thought that the experiments, so far as they had gone, were a great success.

The people in the district were planting up their grants, and he was glad to see a large number of Heveas and Sapiums. Mr. Mansfield advised them as to their cultivations, and they were glad of his assistance.

Professor Harrison reported that two young bulls had been imported from Trinidad, which were twelve months old, and would be ready for service in the next six or eight months. They cost together $158 96. One was a half-bred Hereford, and the other a half-bred polled Angus.

A report on the Board's stock by the Government Veterinary Surgeon was read by the Director, who also stated that they had a young bull, a half-bred between a Holstein cow and a Shorthorn bull, which was a fine young animal.

The Director reported on the movements of the stallions during the season of 1908.

Mr. Payne spoke in favour of an exchange between one of the Government stallions with another stallion in the West

Indies for a season, which would be to the advantage of the colony. He thought that the exchange could be arranged through the medium of a private individual. Dr. Egan agreed with Mr. Payne's suggestion and thought that the time had come when fresh blood should be introduced. The breeders were getting tired of the horses they had and a change would be beneficial.

The Director said he had approached the Imperial Department of Agriculture but they were unable to assist them, as they had practically got rid of all their horses. At the desire of the Stallion Committee he had written to the Trinidad Stock Farm to ascertain whether they could do anything.

The Essequibo County Exhibition.

This was held at Onderneeming on Wednesday, 11th March, having been postponed from September last year on account of the excessively wet season. In the absence of His Excellency the Governor, the Director of Science and Agriculture had the honour of opening the Show.

The Fruits, Vegetables, Economic Products, Flowers, Handicrafts, Needle and Fancy Work, and the School and Model Gardens products were all arranged in the refectory of the Institution, a splendid place for the purpose. The plants were placed on the grass just outside, and the Live Stock was penned at a short distance away in the grounds.

The Show fell far short of the standard of that held previously in Suddie, both in quantity and general quality, in consequence of which the judging was a fairly easy matter. It was disappointing apart from the quality; either there were no entries ! or the number of exhibits in the various classes was small.

In the Fruits.—Sweet oranges were fair; some of the star apples good; golden apples very good; mangoes only one lot good. There were some fine coconuts.

Among the Vegetables the only articles that were distinctly good were pumpkins, tomatoes, one lot of onions and egg-plants

In the Economics, though most of the articles were fairly good, there was little competition. There were only two samples of rice, one white and one brown.

The School and Model Gardens made a very decent show in green vegetables and salads, to which a goodly number of prizes were awarded. The display in these indicates plainly that there is a great possibility of the supply of these articles so much needed being largely increased and through these gardens the public generally could be greatly benefited. Plants and cut flowers were poor. In fact all through the exhibition, although the general appearance was fairly good, a close observer could not fail to notice the paucity in number and quality as compared with other exhibitions.

The exhibit of the Board of Agriculture was, as usual, attractive with a collection of fruit and economic plants, and samples of fruits, vegetables, various economic products, fibres, and samples of the plants from which they are obtained, and samples of rope prepared from coconut fibre.

An object which attracted a good deal of attention was an incubator, with chicks being hatched, belonging to the Industrial School.

Handicrafts were few and of no great merit.

The needlework was less than usual, there were some handsome pieces of drawn threadwork.

J. F. WABY.

Selected Contents of Periodicals.

Journal of the Board of Agriculture and Fisheries, England.

" Advantages of Goat-Keeping," Vol. xiv., No. 12, p. 711, March, 1908.

Agricultural Journal of India.

" The Development of Sisal Hemp Cultivation in India," Vol. ii., Pt. iv. p. 323, October, 1907.

" Practical Remedies for Insect Pests," do. p. 356.

Tropical Agriculturalist.

" Cacao : Its General Culture," Vol. xxx., No. 2, Feb., 1908, p. 124.

" Report on the Rice Iudustry in the United States," Vol. xxx., Nos. 1, 2 and 3, Jan., Feb. and March, 1908.

" Lettuce Culture," Vol. xxx., No 3, March, 1908, p. 211.

" Sisal Fibre Cultivation," Vol. xxx., No. 1, Jan., 1908, p. 14.

Proceedings of the Agricultural Society of Trinidad and Tobago.

" Cultivation of Pine-Apples," Vol. viii., Pt. i., Jan., 1908, p. 21.

" Cacao Manurial Plots," Vol. viii., Pt. 2, Feb., 1908, p. 53.

" Manures," Vol. viii, Pt. 5, May, 1908, p. 185.

Natal Agricultural Journal.

" The Cultivation of Camphor," Vol. xi, No. 1, Jan., 1908, p. 24.

" Fruit Evaporation," Vol. xi., No. 2, Feb., 1908, p. 165.

" Tomato Cultivation," Vol. xi., No. 2, Feb., 1908, p. 171.

North Carolina Agricultural Experiment Station.

Bulletin No. 195.—" Farm Poultry."

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Wounds of Animals and their Treatment.

By Drs. N. S. MAYO and W. W. DIMOCK,

Chief and first assistant, respectively, of the Department of Animal Industry.

(Circular No. 29 of the Central Agronomic Station, Cuba.)

Wounds of animals are so common and their proper treatment so little understood by the ordinary stock owner, that this circular is written with the hope that it may lessen the severe loss to stock owners that results from wounds improperly treated. Many horses and mules die from tetanus (lockjaw) caused by the germs of this disease entering the animal's body through small wounds. Blood poisoning and gangrene also result from the same cause, and a great loss results because animals are unable to work on account of wounds that do not heal promptly. An intelligent treatment of the wounds of animals not only lessens the danger of death but enables the animal to return to its accustomed work more quickly and lessens its suffering.

PREVENTION OF WOUNDS.

Prevention of wounds is always better than the cure, and a large per cent. of the common wounds of animals can be prevented by the exercise of care about the stables, corrals and fences. Loose pieces of barbed wire, boards with nails, sharp projecting corners on stables and stalls should be removed. Wires on fences should be kept tight. With working animals see that the harness, collars, saddles and yokes are properly adjusted, that the bearing surfaces are smooth and distribute the pressure evenly. Whenever a part of the animal's body becomes tender from the friction of the harness or saddle the equipment should be readjusted at once.

KINDS OF WOUNDS.

There are a number of different kinds of wounds but only a few of the most important will be considered in this circular as the treatment is practically the same for all.

Incised wounds are clean cut, such as are produced by a sharp cutting instrument. They are quite common and, other things being equal, are the easiest to treat, and heal the quickest.

Punctured wounds are those made by a more or less sharp body piercing the tissues of the animal. Punctured wounds are usually produced by the animal running against, or stepping on, some sharp body, such as a nail. The most common punctured wounds are those of the foot, caused by the animal stepping on a nail. Punctured wounds, considering their size, are the most serious of all as they are usually quite deep and it is difficult to clean and disinfect them.

Other kinds of wounds are lacerated or torn wounds, such as are caused by barbed wire. Lacerated wounds have rough edges. Other wounds are bruised wounds, where the flesh is bruised as well as cut, and galls that are caused by the rubbing of some part of the harness or equipment of the animal.

ANTISEPTICS.

Before considering the treatment of wounds it is important to discuss the medicines that are used to cure them. These healing medicines are called antiseptics, and they are medicines that will kill germs or prevent their growth and development in wounds.

If it were not for germs or bacteria, all wounds would heal readily and wounds would be of little importance except where vital organs were mechanically crippled. As it is, germs or bacteria get into wounds and growing cause the formation of pus and retard the healing process. Certain germs cause blood poisoning, gangrene and tetanus and very frequently produce the death of the animal when the wound by which they entered the animal's body was of relatively little importance.

Germs get into wounds from the skin and hair of the animal, from the dust of the air and from surgical instruments or other foreign bodies that may come in contact with the wound. Even the hands of a person that may be treating the wound are sources of wound infection unless they have first been carefully cleaned and disinfected. For this reason the greatest cleanliness must be observed in every thing connected with the treatment of wounds.

Cleanliness is the first and most important rule in the treatment of wounds.

In spite of all precautions that can be taken in veterinary surgery, germs will get into the wounds of animals. To kill these germs or to prevent their growth that retards the healing process it is necessary to apply antiseptics. Antiseptics as a rule are poisonous medicines for external use, and they should not be

given internally except when prescribed by a competent person, and then only in small amounts.

Antiseptics, such as are applied to wounds, must be strong enough to kill or prevent the growth of germs in wounds, but it is very important that they be not strong enough to injure the very delicate wounds to which they are applied.

There are a great variety of antiseptics both in a liquid and powdered form, but only a few of the best and simplest will be considered here.

Liquid Antiseptics.

One of the best liquid antiseptics is a solution of bichloride of mercury (corrosive sublimate) in water. One gram of bichloride of mercury is dissolved in one liter (1,000 C.C.) of rain or distilled water, as the mercury does not mix well with well water. This solution is colorless and odorless. It should be plainly labelled.

Another excellent antiseptic is a solution of carbolic acid in water.

For ordinary purposes in the treatment of wounds a solution of 30 grams of pure carbolic acid, dissolved in 1,000 C.C. of water makes a good antiseptic. This is a three per cent. solution, or 1 part of acid dissolved in 33 parts of water. If a wound is discharging pus or smells badly, or in punctured wounds of the foot, a five per cent. solution of carbolic acid can be used a few times. A five per cent. solution is made by dissolving 50 grams of acid in 1,000 C. C. of water, or using one part of acid to 20 parts of water. After disinfecting the wound a few times with the strong solution, then use the weaker or three per cent. solution. From our experience we prefer to use the five per cent. solution a few times on a badly infected wound until it is well disinfected and then use the solution of bichloride of mercury in the strength of 1 to 1,000 parts of water.

Another common and excellent antiseptic is creoline mixed with water. It forms a milky emulsion with a strong odor and is good to prevent screw-flies from laying their eggs in wounds. Creoline is used in the same strength as carbolic acid, that is five per cent. for the first disinfection and after this in a 3 per cent. solution.

An antiseptic and astringent solution that is useful for sores, such as are caused by the friction of harness saddle, is as follows:—

Acetate of lead	24 grams.
Sulphate of zinc	30 „
Water...	1 liter.

Shake this solution well before using.

Powdered Antiseptic.

Powdered antiseptics are valuable for dusting on the surfaces of wounds and sores. An excellent antiseptic powder is iodoform. Another fine antiseptic powder is acetanalid, but it should be finely ground in a mortar.

All antiseptics should be carefully prepared and labelled, giving the kind of solution and strength, and kept in a safe place.

Hemorrhage.

The first thing to be done in the treatment of wounds is to stop an excessive flow of blood. Blood is the vital fluid of the body, and the loss of much blood weakens the animal and consequently retards the healing process.

It is a common practice among the people to bleed domestic animals when they are suffering from various diseases or conditions, but this should not be done. Bleeding is an obsolete practice, and is no more employed in veterinary medicine than it is in human medicine. In practically all cases it does harm rather than good. It debilitates the animal, weakens its power to resist disease and increases its sufferings. Bleeding should not be performed except in rare cases and then only by an intelligent and skilled veterinarian.

In the case of wounds when an artery is severed, the blood escapes with considerable force and is bright red in colour. If a vein is severed the blood escapes from the wound without force and is dark red in colour. When an artery is cut measures to check the flow of blood should be applied to the wound, or on the side of the wound toward the heart of the animal. If a vein is cut the measures should be applied to the wound or to the side away from the heart. For ordinary wounds it is usually sufficient to place a quantity of clean absorbent cotton over the wound and bind it on tightly with a bandage, leaving it several hours. There is a natural tendency for the cut blood vessels to contract, and the blood to form a clot that in a short time will stop the hemorrhage. When a large blood vessel is cut it may be necessary to place a small roll of cloth or a wad of absorbent cotton over the course of the blood vessel and bind it tightly with a bandage. When this does not succeed it may be necessary to grasp the cut end of the blood vessel with a small pair of forceps, or in the absence of those with the fingers, first washing the hands carefully. When the cut end of the blood vessel is secured it should be tied tightly with a stout piece of thread. The ends of the thread should be left long enough so that the thread can be pulled out of the wound in a couple of days.

Cold water applied to a wound or to the bandages over the wound also assist in stopping the hemorrhage. After the hemorrhage has stopped the wound should not be disturbed for several hours.

Cleaning the Wound.

After the hemorrhage is stopped the wound must be cleaned. The hair should be clipped or shaven from the edges of the wound and any small loose pieces of skin or tissue, foreign bodies, such as sticks, dirt, etc., removed. Wounds will not heal until foreign bodies are removed. In cases of punctured wounds it is important to make a very careful examination of the wounds to see that nails or sticks have not been broken off in the wound. It is often necessary to wash dirt from a wound, using clean water and a piece of absorbent cotton.

Disinfecting the Wound.

After the wound is clean and free from all foreign bodies it should be thoroughly disinfected with a good antiseptic solution such as has been previously described. If the wound is deep it is necessary to inject the antiseptic with a syringe having a smooth nozzle, so it will reach the bottom of the wound. The skin and other parts about the wound should also be cleaned and disinfected with the antiseptic. The object of the cleaning and disinfecting is to remove foreign bodies and kill all germs that will retard the healing of the wound.

Closing the Wound.

As a rule wounds gape, leaving an opening that is important to close as it will heal more quickly and leave a smaller scar, hence after the wound is cleaned and disinfected the edges should be brought and held together if possible. In some cases this is difficult or impossible, particularly in wounds where the muscles of the legs are cut across, as the cut muscles contract and it is often impossible to bring them together, or if they are brought together the least movement of the animal tears the stitches out.

Wounds can be closed in several ways. The most convenient method where it can be used is by means of a bandage. The bandage should be of stout cloth, two and one-half to three inches wide and six feet long, rolled into a neat roll (See Fig. 1).

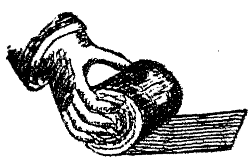

Figure No. 1.

Before the bandage is applied the wound should be covered with a layer of absorbent cotton saturated with a weak antiseptic, such as a 1 to 1,000 solution of bichloride of mercury or a 3 per cent.

solution of carbolic acid. Care must be taken that the cotton does not get between the edges of the wound. In case the absorbent cotton cannot be applied, dust the outside of the wound with a powdered antiseptic. Apply the bandage, beginning from below and winding upward, putting it on smoothly and firmly, but not tight enough to interfere with the circulation of the blood, and be careful to get the edges of the wound together as evenly as possible.

To apply a bandage to an animal so that it will stay in position and hold the parts together properly requires considerable skill that can only be obtained by practice. Be careful and not get the bandage too tight.

Bandages should be removed every day at first to see that pus does not gather in the wound and be retained by the bandage. When the bandage is removed the wound should be carefully washed with clean warm water; if there is any pus, wet thoroughly with the antiseptic solution and re-apply the cotton and bandage. If there is no pus in the wound dust on more antiseptic and bandage as before.

Sewing up a Wound.

Where it is not practical to close a wound by a bandage it can frequently be closed by sewing it together. For this purpose it is necessary to have a surgeon's needle, which is a curved needle with cutting edges. A needle of good form and size is shown in Figure 2.

Figure No. 2.

A poor substitute can be made by grinding a darning needle to a triangular form or a triangular tobacco needle can be used, but they are very unsatisfactory as it is difficult to push them through the skin of a large animal. A good surgeon's needle can be purchased of any surgical supply store for a few cents, and no stock farm should be without one. For sewing up a wound a special kind of silk thread is made for surgeon's use, and can be purchased in the drug stores for a few cents. In the absence of this the common embroidery silk works well. Use the coarsest kind of white or light coloured silk. If the thread is fine it can be doubled. In sewing up a wound there is very little pain except the prick of the needle when it passes through the skin. A twist on the nose is usually sufficient to restrain a horse. A dog's mouth should be tied shut with a stout bandage.

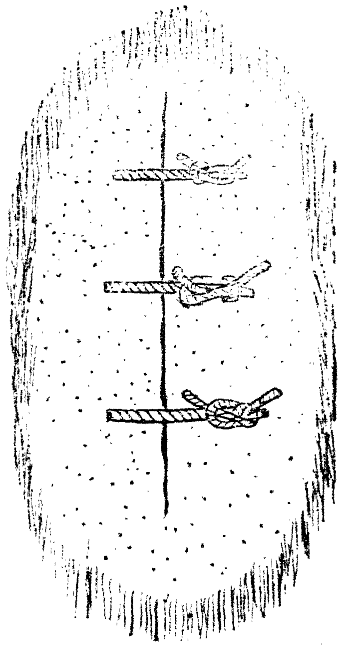

Figure No. 3.

In sewing up a wound the stitches should be just close enough together so that the wound will not gape between the stitches. It is best to take one stitch and tie it, then cut the silk and take another as shown in Figure 3. The needle should be inserted far enough back from the edge of the wound so that it will not tear out easily, and it is very important that the two sides of the wound be brought evenly together as near as possible as they were before the wound was made.

In case of a triangular wound it is a good plan to take the first stitch at the angle as shown in Figure 4. If the wound is deep the stitches should be taken rather deep. Do not sew up the skin alone and leave the wound gaping below. Draw the stitches tight enough to bring the lips of the wound nicely together. Avoid drawing them too tight as there is some swelling afterward that is liable to make the stitche,

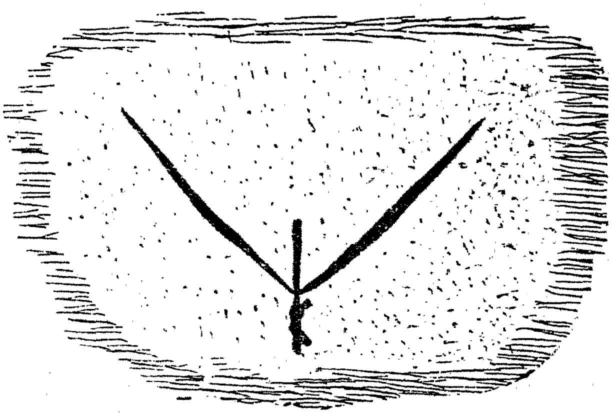

Figure No. 4.

tear out. In sewing up a large wound it is well to leave a very small opening at the bottom to allow the pus to drain out.

Wounds should be sewed up at once as after a few days the inflammation makes them very sore and it is a very difficult matter to close them.

After the wound is closed apply antiseptics freely, and if possible bandage lightly. Dust on some powdered antiseptic.

WOUNDS OF THE FEET.

Wounds of the feet are the most common and the most serious according to their size. They are usually punctured wounds produced by the animal's stepping on a nail or other sharp object that penetrates the horny hoof and injures the sensitive tissues within. These wounds are particularly dangerous to horses and mules in Cuba on account of the danger that the wound may become infected with the germs of tetanus or lockjaw and cause this serious disease.

Whenever an animal is noticed to be lame the foot should be very carefully cleaned and a thorough examination should be made for nails in the foot, or for the minute opening that a nail would make in the hoof. In case a nail is found it should be carefully extracted so as to avoid breaking it off in the foot. Use a pair of pincers for this purpose. Trim away the horn from around the wound down to the sensitive tissue and disinfect the wound thoroughly. For this purpose pure turpentine is good, or a 5 per cent. solution of carbolic acid. After cleaning and disinfecting the wound well, cover it with a piece of absorbent cotton wet with 5 per cent. carbolic acid and bind it on with a strong bandage made of burlaps or coarse sacking. The horse must be kept on a clean dry floor and the wound dressed daily with the carbolic acid solution. If pus has formed in the foot as a result of the wound the horn must be cut away to give free access to the part, the pus must be washed away and the whole disinfected with 5 per cent. carbolic acid. In many cases it is necessary to inject the antiseptic with a syringe. Then the wound should be treated daily as previously described.

After a punctured wound of the foot has healed and the new horn has begun to grow the cavity can be filled with pine tar, a piece of leather nailed on under the shoe to protect the foot and the animal put to work. The leather should be cut away in a week or ten days.

SURGICAL WOUNDS.

It is often necessary to make wounds in animals. The most

common surgical wounds are those made in opening abscesses and in castration. Before making a wound the hair should be shaven or clipped from the part and the skin thoroughly washed with soap and water and then disinfected with a 5 per cent. carbolic solution or creoline of equal strength, before making the incision. After operating disinfect the wound and treat it daily until healed. Many horses and other animals are not castrated because of the danger of death from tetanus or blood poisoning following the operation. If the parts are well cleaned and disinfected before operating and the operation properly performed and the wound is kept clean and disinfected there is practically no danger from these diseases. Following castration it is often necessary to use a syringe to inject the antiseptic in the wounds in the scrotum.

PROUD FLESH.

There sometimes forms in wounds a peculiar abnormal growth of new tissue that is commonly called "proud flesh." This abnormal growth retards the healing process so that it is often necessary to destroy the proud flesh. This is best done by moistening it and rubbing it lightly with a stick of lunar caustic (nitrate of silver). One application is usually sufficient.

SCREW WORMS.

All wounds should be examined daily to see that they are not attacked by screw worms. When these parasites attack a wound there is a bloody watery discharge from it. In such a case the wound should be saturated with a 20 per cent. solution of creoline in water (1 part of creoline to 4 parts of water). In a few minutes the small white worms will begin to wriggle out of the wound. The wound should then be treated daily with a weak antiseptic solution of carbolic acid or creoline.

SUMMARY.

Every farm on which stock is kept should keep on hand a roll of absorbent cotton, plenty of antiseptic medicine and a surgeon's needle for the treatment of wounds.

Wounds should be prevented as far as possible by removing dangerous objects from stables and corrals. See that the harness, saddles and yokes are properly adjusted.

Wounds are dangerous, not only because of the direct injury to the animal, but also because germs of disease may get in the wound and cause the death of the animal.

Punctured wounds, particularly of the feet, are the most common and, according to their size, most dangerous.

It is important to keep germs from getting into wounds and to prevent those that do get in from growing. For this purpose medicines called antiseptics are used.

Perfect cleanliness is the most important thing in the treatment of wounds.

The first thing in the treatment of wounds is to stop the excessive flow of blood.

Clean the wound thoroughly and use antiseptics freely.

Bring the edges of the wound together and keep them together.

Keep the wound clean and well dressed with antiseptics, but do not disturb it more than necessary.

Watch the wound carefully to prevent screw worms attacking it.

Paper from Rice Straw.

Some time back inquiries were made by persons interested in the rice growing industry of this colony as to whether the rice straw could not be utilized for the manufacture of paper in the same way as the straw of other cereals, viz., rye, wheat, oats and barley, is employed in countries where these are grown. The following note from the "Louisiana Planter and Sugar Manufacturer," Vol. XL., No 25, provides an answer to this question and shows that by the establishment of a pulp mill, paper pulp might be produced lccally for shipment to paper mills to be there manufactured into paper.

"Rice farmers have long been in search for some better use for their straw than feeding it to stock for which it is worth very little in the way of nourishment. Recent advices from Beaumont, Texas, state that W. D. Wing, a prominent capitalist of Bangor, Maine, became interested in the proposition of making paper pulp from rice straw, and to ascertain the elemental qualities of the straw in this respect he sent some of the straw to a chemist for a pulp mill in Boston, and had some sample paper made from the straw. During his recent visit Mr. Wing exhibited these samples. Notwithstanding they were made entirely by hand in a laboratory, the samples proved to be excellent quality of paper, capable of retaining ink and suitable for many purposes for which paper is used.

Mr. Wing owns a large amount of stock in a pulp mill in Maine, and is therefore interested in this matter from another standpoint than to merely make use of the rice straw. His experiments thus far have proved conclusively that rice straw will make an excellent pulp for making paper, and it is his idea that a pulp mill should be built in this territory and perhaps several mills in different sections of the rice belt for the purpose of utilising this straw. He does not go into the question of building paper mills here, for the reason that paper mills are very expensive, and there may be many questions involved in the operation of a paper mill which are not involved in a pulp mill. At any rate, Mr. Wing for the present is interested in the pulp proposition, and his plan roughly outlined is to establish these mills, make the pulp from the rice straw, and ship it to the paper mllis in the New England States.

From estimates so far made Mr. Wing believes that the farmer can net $2 per ton for the straw on the farm. This does not include hauling, baling and shipping but means that the rice farmer will receive $2 for each ton of rice straw produced.

Mr. Wing has arranged to ship a large quantity of straw to his mill and demonstrate satisfactorily what sort of paper can be made from the straw. Mr. Wing is not speculating lightly in this matter, but is thoroughly interested, and if his expectation as to the merit in the straw prove out, he will lose no time in building his pulp mill somewhere in the belt and will ship the pulp to the mill in the north. In addition to the value of the straw for paper making, Mr. Wing finds that there is a large quantity of rice left in the straw, and from this he believes very many articles of trade, such as alcohol and feed-stuffs, can be made. In fact Mr. Wing believes that rice straw can be utilized almost as much as cotton seed, which not so many years ago were thrown away, as many farmers now living can remember. As there are about 60,000 acres of rice planted in Jefferson County each season, it will be seen that there is produced about 120,000 tons of rice straw, which, at $2 per ton, will yield $240,000, which has heretofore and would otherwise be thrown away."—"Abbeville Meridional."

Pruning of Sapium, Funtumia and Hevea.

The following set of directions for the pruning of young rubber trees, prepared by Messrs. Ward and Waby, Agricultural Superintendent and Head Gardener, appeared in "The Official Gazette" for August 19, 1908.

Sapium.—In its natural state the Sapium quickly forms a tall tree losing its lower branches in consequence of want of light in the bush where it grows, so that a fairly clean stem is produced. In the planted state in cleared land numerous branches are formed from the very base giving the trees a pyramidal form, and as plenty of light and air are available these branches continue to spread so that very bushy trees result.

As it is necessary to obtain a clear stem for several feet in height for tapping purposes these branches must be artificially removed, but the operation must be performed piecemeal for two reasons.

1. If these lower branches be removed clear to the stem the young trees will form dense heads on which the wind will play so that its force cause the trees to rock about and bend considerably thus loosening them in the loose soil, probably overturning them, making it very necessary to stake each tree; but if these branches be shortened to about half their length they help to maintain the equipoise of the trees, obviating in a great measure the necessity for staking and saving that expense.

2. By taking off the young branches clear to the stem—as was being done on one or two of the cultivations visited—the process of thickening the stem must be retarded as all the leaves are taken away, so that no material is provided for that purpose except that sent down from the upper branches which is not sufficient for the length of stem.

We suggest:—As soon as the branches have grown say to 3 feet long, *i.e.*, before the secondaries are formed, to cut them back to about half their length, which will leave sufficient foliage to carry on the proper functions, leaving the top whorl of branches to carry up the head; when they have lengthened sufficiently these to be cut the same as the lower branches, continuing to cut each whorl till the trees have become stable; by this means the wind pressure will be relieved and staking should not be necessary.

No doubt in time the lower branches will fall off naturally, but if they do not, they can be removed a few at a time so as to obtain the necessary clean stem without shock.

Funtumia.—The Funtumia in its first growth gives one the idea of being a large growing shrub rather than a large tree, as it almost invariably produces, either several stems or several strong woody branches.

To secure a one-stemmed plant all but the central growth should be cut away clean. As a rule the plant is well clothed with foliage, none of this should be removed from the central stem, but any branches forming on this should be treated in the same way as that suggested for Sapium.

Hevea.—The Hevea plants grow with a slender stem rarely branching for several feet; even when branches are formed we do not consider they should be cut off clean to the stem till the trees become fairly well established. When the head forms at say 10 to 12 feet high the branches there should be shortened till a good stem is obtained so as to prevent the play of the wind.

JNO. F. WABY.

R. WARD.

Botanic Gardens,
26th March, 1908.

New Uses for Molasses.

Probably most people in the colony are aware that molasses is largely used for the manufacture of rum and for making the well-known cattle food, "molascuit."

But that this substance is also efficient in keeping cattle free from ticks, in acting as a poison to ticks when they are found on cattle, as well as for extinguishing fires and for preserving timber are facts which at first sight seem to be opposed to what one would have imagined.

The following extracts from recent numbers of "The Louisiana Planter," referring to new uses to which molasses may be put, are considered to be of sufficient general interest for publishing in this Journal.

For Keeping Away Cattle Ticks.

Experiments made at Brisbane, Australia, with some valuable dairy cattle have shown that the consumption of molasses by the dairy cattle was in some manner inimical to the existence of cattle ticks. In the Logan district a farmer had kept his cattle free of red water by giving them molasses, and this report led Mr. Thurlow of Brisbane to experiment with dairy cattle. He prepared for them a solution of water and molasses, about half and half, which he called a "lick," to which the animals went with freedom, and ever since all of the animals were free from ticks. The proportion of molasses was subsequently reduced, and even then it was found quite effective in keeping the stock clean. No difficulty is reported in developing a taste for the molasses and water, and the use for the purpose of freeing animals of ticks is considered now as a demonstrated success.

For Killing Cattle Ticks.

Mr. T. W. Crawford, of the Mossman Central Factory, reported that a good deal of trouble had been experienced with ticks among the dairy cattle at that centre and to so great an extent that at one time they were reduced to the use of condensed milk exclusively; they then hit upon the idea of an external molasses wash, using two parts of water to one of molasses. The cows were smeared with this mixture, and it was said that every tick on the animals was dead by the following morning, and that now they have no trouble with the ticks at the mill. It is even said that molasses is superior to the ordinary cattle dips used for killing ticks, as the molasses kills the ticks almost immediately, and the standard cattle dip takes several days.

Further, it is not necessary to take any precaution against animals licking themselves, as the molasses does them more good than harm ; incidentally, it is stated that in milking a smeared cow, it is only necessary for the operator to throw a bag over the animal's loins, against which he can rest his head.

So it goes, and thus we are learning continually new uses for molasses and shall hope in time that it will regain its old proportionate value to crystallized sugar.

For Extinguishing Fires.

It is surprising how few people are acquainted with the real nature and properties of molasses. Even men who have worked in sugar mills and distilleries for years often betray ignorance in this respect. The writer had occasion some time ago to scientifically investigate the properties of molasses, and found it a very difficult problem to burn off a large quantity of surplus molasses without the aid of specially constructed furnaces. Molasses is not the highly inflammable mixture that people imagine it to be. It would be practically impossible to set a tank of molasses on fire by any means whatever. Even a mixture of molasses and methylated spirits or sulphur will burn very imperfectly at first, and finally smoulder and die out. A charge of molasses will extinguish or damp down the strongest furnace fire in a few minutes. A jet of molasses played on burning wood will instantly extinguish the fire, and the wood cannot be again fired until the molasses is removed from the surface. For extinguishing large tanks of burning oil, kerosene or spirit, there is nothing more effective than bags or tarpaulins steeped in molasses, and when such tanks are in danger of being fired they should be covered over and made air tight with tarpaulins that have previously been immersed in heavy molasses.—"Bundaberg Mail," Australia.

For Preserving Timber.

Quite an interest was excited some months back in a method of timber preservation by utilizing sugar or molasses instead of the ordinary creosote for this work. We have the analogy in pork products that are preserved by wood smoke, which is a creosote process and sugar-cured ham, in which the curing, or preservation by sugar is more effective than by the wood smoke, or creosote process. It would seem very possible that all of the low grade molasses of Louisiana that was not used at home as stock food could readily be used as a wood preservative if efforts were made to develop the business. "The Railway Engineering Review," of January 14, referring to the Powell

process, which was being experimented with in England, said that it consisted in boiling the wood in a combined saccharine solution whereby the latent air is driven out and the albumen and sap of the wood coagulated. The wood is then allowed to cool in the solution until it is sufficiently impregnated, and finally it is dried at a high temperature. For rough wood, such as railroad ties, paving blocks, etc., beet syrup is used for the solution, but for light coloured or for fine woods, the best beet sugar is used.

The plan, as described in "The Railway Engineering Review," is simple. The wood is packed on trucks, which are run into the cylinders lined inside with pipes which serve the double purpose of heating and cooling the solution, and all so arranged that all the solution can circulate all around each piece of wood. The cylinder is closed as in creosoting, and the solution is run into it and afterwards pumped back to a tank. We are not at present familiar with the prices of creosote per barrel, but in our purchases of it in the past its value has been higher than that of common molasses, and yet the belief in England in connection with these experiments has been that the molasses or sugar was a better preservative than creosote.

Epizoötic Lymphangitis.*

To Owners of Horses and Cattle, Planters, &c.

A WARNING!

1. There has recently been introduced into British Guiana a contagious disease known as "Epizoötic Lymphangitis" which affects horses, asses and mules. It has many years existed among horses in Italy, and in several other countries in Europe; it is also prevalent in India, in some parts of South Africa and the United States.

2. The characteristic symptom of the disease consists of a swollen condition of the lymphatics of the skin on the inside of the hind legs, but the same condition may also be present on the side of the neck, or on the body. In most cases small nodules, varying in size from a pea to a hazel nut, will be found which eventually burst and discharge a small quantity of purulent material containing an organism—the cryptococcus, which is the cause of the disease.

3. The cryptococcus when microscopically examined presents itself as an ovoid body, with a distinct double-contoured envelope and highly refractile contents. Owing to its considerable size and its characteristic form it is readily detected under a magnification of 400, and to this end it is not necessary to use any stain. The organism is easily transferred from the wound of a diseased horse to a wound on another horse not affected with this disease, and the most common means of such transfer is no doubt by the agency of sponges, rubbers, brushes, or other stable utensils which have been used about diseased horses, or possibly by the hands of the attendant.

4. From the clinical symptoms, epizoötic lymphangitis may easily be mistaken for the farcy form of glanders: it can, however, be differentiated from that disease by a microscopical examination of some of the discharge from one of the ulcers, when the cryptococcus, which is the cause of the disease, will be found; or by an application of the mallein test, to which epizoötic lymphangitis does not respond.

5. In all instances where a case of epizoötic lymphangitis is discovered the animal should at once be isolated, and separate implements should be used exclusively for the diseased animal.

*A very full account of this disease was published in the previous number of this Journal.—ED.

6. Inasmuch as epizoötic lymphangitis does not ordinarily lend itself to any known curative form of treatment, the owner would be well advised to slaughter the affected animal at once in order to prevent the disease being communicated to other animals in his possession or charge.

7. As the germs of the disease have been known to linger about a stable for a very considerable period, a rigid system of cleansing and disinfection should be applied to the whole of the stable or other place in which an affected horse has been kept, and all rubbers, sponges, brushes, and stable utensils used about affected horses should be burnt.

JOHN A. RALEIGH, V.S.,
Government Veterinary Surgeon.

Veterinary Branch,
Medical Department,
British Guiana.

Notes.

Distinction between Shaddock and Grape Fruit.

In this colony there is a general tendency to confuse the Shaddock with the Grape Fruit. This is particularly noticeable at the various Agricultural Shows, where it frequently happens that either all of the exhibitors have entered their grape fruits as shaddocks and *vice versa*, or both classes include some exhibits of each fruit. This ought not to be the case, because the difference between the two fruits is very obvious and one can seldom be mistaken for the other, and every modern work dealing with citrus fruits defines clearly the distinction between these two.

Probably the best general account of these fruits is to be found in some notes by Sir Daniel Morris, K.C.M.G., which appeared in the West Indian Bulletin, Vol. VI, No. 3, 1905, to which I am indebted for much of the following information.

The Shaddock, Pumelow or Pomelo as it is variously termed is usually much larger than the grape fruit. Large specimens have been known which measured more than two feet in circumference and weighed from 15 to 20 lb. The fruit is either spherical or pear-shaped, the rind is usually very thick especially in the common kinds, and the pulp is more usually of a crimson colour, sometimes however being a pale pink, approaching to a very light yellow.

Often it happens when the fruit is cut open that the centre is found to be occupied by a hollow space and more frequently than not all of the seeds are aborted.

The Grape Fruit, also known as Forbidden Fruit and Paradise Fruit may be also either spherical or pear-shaped. The skin is usually pale yellow, thin and smooth. The centre of the fruit is usually occupied by a small core and there is seldom a hollow space, while the seeds are generally numerous. The colour of the flesh is mostly pale yellow, but varieties with red pulp are known.

The grape fruit generally far surpasses the shaddock in flavour. Its sweet and refreshing pulp, full of juice, in addition to its alleged medicinal qualities, has brought it into high favour in the United States and there is a very large demand for it.

Rice Bugs.

Two separate complaints have been received from the Mahaicony district that rice-bugs are causing considerable injury to the young rice. Specimens of the insect that have been received

show that it belongs to the class Heteroptera, the individuals of which are furnished with a long pointed beak and generally obtain their food by sucking the juices of plants. The rice-bug has been identified as Carpocoris pœcila, Dall, and is a brownish insect with some bright yellow markings on its back, measuring rather less than ⅜ inch in length. In common with the other members of its class it emits a very disagreeable odour when handled. In 1904 there were reports of the same insect damaging rice in the Island of Leguan.

The injury is caused by the insect sucking the young developing grain after it has begun to swell, so that it fails to reach maturity and all that is left are the empty glumes. Frequently every grain on a stalk is thus attacked and where the bugs are plentiful as is often the case it may readily be understood that the loss which they occasion may be very considerable.

This insect is by no means uncommon, and I have found it in various parts of the colony, mostly on different species of grass.

In India where another rice-bug is found of quite a different species, the following simple method is employed for its extermination. A light bag 8 feet wide is run rapidly through the field brushing the tops of the rice, which sweeps up the bugs, and though some escape most of them are captured. The bag is made much more effective if it is first soaked in kerosine oil. By using this bag there is found to be no difficulty in checking this pest.

The same plan is recommended for trial in this colony in fields where the rice-bug is troublesome.

Keeping Powers of Ripe Mangoes.

The following is a report on the results of some experiments which were recently carried out by the Government Botanist, acting under instructions received from the Director of Science and Agriculture, with the object of testing the keeping powers of the various varieties of cultivated mangoes when ripe by immersing them for 10 minutes in cold water containing 3 per cent. commercial formalin and of comparing their keeping powers with others not so treated.

1. This has been carried out with 260 mangoes belonging to 23 varieties picked at various dates between the 7th February and the middle of March.

2. A tabulated statement of results is herewith submitted.

3. In all cases the mangoes were gathered in pairs, each pair at the same time. One was immersed in a 3 per cent. solution of

formalin for 10 minutes, the other merely kept as a control under exactly similar conditions. They were examined daily, and the dates when they became soft or rotten or mildewed noted.

4. Contrary to similar trials made with formalin on soft-skinned fruits the use of formalin was found to lessen instead of increasing the average number of days which elapsed before the mangoes became more or less unfit for eating, except with 3 varieties. Every care was used in handling the mangoes during the treatment with formalin to avoid bruising them and so hastening their decay.

5. One important fact that these experiments have shown is that, without any special precaution beyond care in picking and handling, most varieties of grafted mangoes will keep on an average for about 10 or 12 days, even in our climate. In cool storage it is likely that their keeping powers will be much increased.

6. During the earlier trials it was found that decay usually originated at the stalk end of the fruit, although the stalk had not been broken off. In gathering the fruit it must not be pulled, but the stalk must be cut, because the pull required to break the stalk is sufficient to bruise the stalk-end of the fruit and cause decay to set in earlier at this place.

Tabulated Statement of Results.

Variety.	No. Tried.	Average No. of days the Fruits kept.		Average No. of days increase or decrease in keeping powers due to Formalin.	Longest No. of days any Fruit kept.	
		Treated with 3 o/o Formalin.	Untreated		Treated with 3 o/o Formalin.	Untreated
1. Dare	20	7·8	9·8	—2	12	13
2. D'Or	18	9·3	11·1	—1·8	12	15
3. Ceylon	6	7·7	10·7	—3	8	13
4. Jamaica No. 11 ...	20	10·3	11·6	—1·3	14	16
5. Josephine	4	11·	14·	—3	13	17
6. Seedling Madame ...	16	12·	12·	0	15	14
7. No. 2 Canal... ...	26	10·8	11·9	—1·1	16	16
8. Madame	32	12·2	13·9	—1·7	17	19
9. Chinoise	10	5·8	11·2	—5·4	8	15
10. Bombay 25	20	10·4	13·	—2·6	15	16
11. Peters	4	7·5	9·	—1·5	9	10
12. Martin	6	8·	6·3	1·7	11	9
13. Bangalore	16	12·6	11·9	— ·7	19	14
14. Divine	4	9·	10·5	—1·5	10	12
15. Mrs. Francis ...	4	12·5	10·5	2	13	11
16. Peach...	4	12·	17·	—5	14	20
17. Mrs. White	6	11·3	15·3	—4	14	17
18. Bombay 26	10	9·2	12·4	—3·2	12	15
19. Bombay 22	2	...	...	...	15	17
10. E. I. Seedling ...	4	12·	12·5	— ·5	12	14
21. Kerschapotte ...	12	9·3	10·5	—2·2	14	14
22. Crassous	10	11·6	12·8	—1·2	14	15
23. Bombay 27	6	10·	13·6	—3·6	11	15

Bordeaux Mixture.

There is no fungicide, or preparation for destroying and preventing the attacks of the various fungus diseases to which plants are subject, of more general utility than Bordeaux mixture, both to the agriculturalist and the horticulturalist. It is made from copper sulphate and freshly slaked lime, the following being the proportions recommended :—

Copper Sulphate	...	5 lbs.
Fresh Quicklime	...	5 lbs.
Water ...	...	50 gallons.

When only a small quantity of the mixture is required the following quantities may be used :—

Copper Sulphate	...	1 lb.
Fresh Quicklime	...	1 lb.
Water ...	...	10 gallons.

To prepare the mixture the copper sulphate is first dissolved in half the quantity of water to be used. This must be done in a wooden tub or barrel, and a galvanized or iron vessel must on no account be used as it will be attacked by the copper sulphate. The lime is slowly slaked and then mixed with the other half of the water and well stirred so as to form a paste or milk of lime which is then poured into the solution of copper sulphate or both may be poured together into a third barrel. The mixture so produced should have a sky-blue colour, but it requires to be tested to make certain that all of the copper has been precipitated. A simple test is to place a clean steel knife into it for about a minute and if it remains bright the mixture is safe to use. But if it becomes covered with a red deposit of copper more milk of lime must be added until a deposit is no longer formed.

The mixture must be stirred before using and will keep good for only a few days.

In the last Report of the Woburn Experimental Fruit Farm for 1908, an account is given of some investigations into the composition of Bordeaux mixture and a new method for its preparation is described which has many advantages over the usual method mentioned above. Not the least of these is economy as only two-fifths of the quantity of copper sulphate are required.

" To make this mixture clear lime-water instead of milk of lime, must be used ; 6 lb. 6½ oz. of copper sulphate are dissolved in water in a wooden pail or tub : and into another large tub of water 2 or 3 lb. of fresh quicklime are put : after being stirred several times and allowed to settle, 86 gallons of the clear lime

water are tapped off and mixed with the copper sulphate the whole being made up to 100 gallons by the addition of rain-water."

Where only a small quantity, say 10 gallons, is required, 10¼ oz. of copper sulphate and about ¼ lb. of quicklime would be used.

Of course the mixture must be tested as before for unprecipitated copper, but the steel-knife test is objected to as neither delicate nor safe. A solution of potassium ferrocyanide which can be purchased at a chemist's for a few cents is to be used instead. In testing, place a little of the Bordeaux mixture after a thorough stirring in a cup or saucer and add a few drops of the potassium ferrocyanide solution. If a red colour is produced a little more lime-water must be added and some of the mixture again tested. This must be continued until no red stain is formed with the solution. Any excess of lime added above the minimum required for the complete precipitation of the copper, weakens the mixture and represents a direct loss of money. By avoiding excess of lime there is also probably less danger in scorching foliage than with the ordinary mixture.

Prepared in the way described above Bordeaux mixture has been used in the Nursery of the Botanic Gardens for killing a fungus disease attacking the leaves of Maidenhair ferns without causing any injury to the delicate fronds.

FEEDING OF CHICKENS.

In the Report of the Dominica Agricultural School for 1906-1907, some useful notes are given on the feeding and care of chickens.

The chickens were hatched in an incubator and accommodated for the first week in a brooder heated to 90° F., during the second and third weeks the temperature was reduced to 80° F. During the second week they were confined to the brooder but in the third week they were given in addition a covered earth run.

The heat was then removed and the chicks allowed to occupy the cold brooder for two weeks more. After five weeks the chicks were placed in a large house without a grass run (perches were provided after the twelfth week.)

The floor of the brooder was covered with sand and grit to a depth of ¼ inch, upon this was placed a layer of finely cut straw and dry grass. All food supplied during the first five weeks was

scattered among this litter, so as to cause the birds to scratch for their food.

This is beyond doubt one of the most essential points to be observed in successful rearing, as it causes the chick to take a fair amount of exercise in obtaining its food which tends to keep it in a healthy condition.

During the time the chicks occupied the brooder, fresh green food was supplied twice a day. This consisted of spinach, alfalfa and cabbage leaves, the whole of which was passed through a closely set clover cutter and thoroughly mixed up previous to being fed.

After the first three weeks it is better to supply the green food whole by suspending it within easy reach of the chicks. Dry food should be given four or five times each day. A "little and often" should be the rule; if the chicks are fed but twice a day it causes them to stuff their crops and become lazy. Such birds seldom survive the twelfth week. On the other hand if a little food is supplied about every three hours, the chicks are kept in constant exercise.

Incorrect feeding is usually the chief cause of mortality among chicks, this generally resulting from diarrhœa, or from the birds becoming crop-bound.

The following dietary can be fully recommended. The first two weeks egg and bread should be given. The egg should be boiled until it is quite hard, and the whole of it—yolk, white and shell—minced and thoroughly mixed with stale bread. This may be given the first thing in the morning and the last thing at night. During the day, coarse oatmeal should be given raw every three hours.

From the time the chicks are two days old, a limited amount of animal food should always be given. This may be supplied in the form of wood-ants, maggots, worms, etc. In the event of these being unobtainable minced raw meat, scraps and ground bone should be given. During the third, fourth and fifth weeks, brown rice may be substituted for the egg and bread, this being fed alternately with the oatmeal.

After this time any of the following foods may be given : finely ground corn, ground oats, barley, buckwheat, etc., or cornmeal mixed with hot water, and made into a crumbly mass, so that when thrown to the birds it falls apart easily. A good supply of grit must always be obtainable ; broken oyster shell is an excellent material.

Rubber Extraction From Small Trees.

The Secretary of the West Indian Committee, has forwarded to the Imperial Commissioner of Agriculture a copy of a letter received by him from Dr. W. A. Dyes, of Manchester, dealing with the extraction of rubber from very young trees and rubber-yielding bushes. Dr. Dyes states that by a method of extraction lately invented, it is possible to obtain rubber of a high degree of purity from small trees and bushes, the latex of which contains no more than 12 to 15 per cent of rubber. He further mentions that one factory has been already established on the Continent which is working successfully by this system, the necessary rubber plants being imported from Mexico and Africa.

Dr. Dyes is anxious to receive from the West Indies, samples of plants (small trees or bushes) containing from 10 to 15 per cent of rubber. If planters who are interested in this matter, and who are able to obtain a supply of plants such as are required, will communicate with the Imperial Commissioner of Agriculture, Barbados, arrangements could be made to forward samples (of from 5 to 10 lb. in weight) for purposes of experiment by Dr. Dyes.—" The Agricultural News," Vol. VII, No. 161, p. 201.

"Hardback" Beetles.

The "Hardback" beetles are too well known in the colony to require any description. Three common kinds may be distinguished :—

The large, Black Hardback (Dyscinetus dubius, Oliv.); the small Black Hardback (Dyscinetus bidentatus, Burm.); and the Brown Hardback (Cyclocephala signata, Drury) the last of which is of a light brown colour with a few dark markings on the thorax and wing-cases. A few other species belonging to the same family occasionally appear with these.

They are also known as "cockies," or as Mr. Jenman spells it in one of his notes in "Farm, Field and Forest," "cuckles," but this term is also applied to the large beetles which attack coconut palms.

At certain times of the year, chiefly after heavy rains, "Hardbacks" appear in Georgetown in almost incredible numbers. They enter the houses, attracted by the electric lights in hundreds, and after buzzing round these for a time, alight on the floor or the table, whichever happens to be directly below, so as to cause much annoyance and discomfort.

They are strictly nocturnal insects, and it is very curious to notice that, however plentiful they may have been on the previous night, there is seldom one to be seen on the following morning.

It is not generally known, however, except to agriculturalists, that at times they become very troublesome pests to certain field crops.

In May of the present year the writer went to investigate a complaint made by some farmers, who had recently taken in some lands on the "Ogle" estates, that their provisions were being destroyed by "cockles." In a specimen of a plantain stump forwarded at the same time for examination there were found two of the small Hardback beetles.

The inquiry showed that the cultivations where the injury had been done were situated on some new land which has been recently cleared, about 6 miles aback of Plaisance village. The provisions attacked were chiefly plantains, also some eddoes and tannias. There were no bananas, sweet potatoes or yams growing on these plots, so there was no means of ascertaining whether the beetles attack these as well, but cassava growing in the same fields was left quite untouched.

The beetle usually attacks a newly planted plantain sucker at about the level of the ground or a little below or above, eating all round the outside of it but seldom penetrating deeper. The result is that decay sets in and either the sucker is killed or if the centre survives a weakly plant is produced.

One farmer who has planted 300 suckers has been obliged to supply all of these twice, and most of the last lot of supplies have been killed out in the same way as the others. He stated that the first lot were attacked the day after they were planted and that he has taken as many as 30 of the beetles out of one dead sucker. Many of those I examined had 10 or 12 beetles feeding on them. The land is quite new and there were only young suckers, so I was unable to ascertain whether the beetles also attack full-grown plantains.

In the case of eddoes or tannias, as the heads are planted low down in the soil, the insects are obliged to burrow more deeply in order to reach these, but many had been attacked.

In dealing with an insect pest or a fungus disease one of the first and most important things to be done is to find out as much as possible about its life-history. When this has been completely ascertained it is often an easy matter to suggest a simple and effective method for destroying the pest or disease.

The whole of this damage had been done by the small black Hardback, and there was no other species seen. Unfortunately there were none of the earlier stages or "grubs" of the beetles to be found, and as the ground had been burnt over only a short while before, the beetles could not have bred on the cultivations, but must have migrated from some other place.

It is stated on good authority that the insects breed in the pegass lands of the surrounding savannahs, a few inches below the surface of the ground, and that in digging the extension of the Lamaha canal they were turned up plentifully. These statements are in entire agreement with the habits of the beetles of the sub-family *Rutelinæ* to which the present insects belong, many of which are known in their larval state to live in the soil and feed upon the roots of grasses and other plants.

When parts of the savannah become inundated by heavy rains the beetles are driven out, which explains their usual appearance during spells of wet weather.

Remedies.

A part of this land was originally under heavy bush, including

Eta Palms and small trees. After this was cut down it was burnt in the usual way to get rid of it, and the plantain suckers on this part have been very little attacked by the beetles. It appears as if the large quantity of wood-ashes left in the soil after the burning took place had kept away the beetles. This naturally suggests that when they can be obtained, a small quantity of wood-ashes placed around the plantain sucker or the head of the tannia or eddo will be likely to prove effective in preventing the attacks of the beetles, and at a very small cost.

Freshly slaked lime might also be used in the same way, as most insects have a great dislike for lime. The application of wood-ashes or lime is also likely to be beneficial to the plants themselves.

Mr. Junor, Manager of Pln. Vryheid's Lust, says that he has found the following remedy effective and cheap: "Mix a small quantity of Jeyes' disinfectant in a large tub of water and steep the suckers in the solution before planting." Probably a preparation which is obtainable locally known as chloro-naphtholeum will serve the same purpose, and will be found to be cheaper and quite as efficacious. It has a strong but not unpleasant odour, and when mixed with water is very effective in destroying ants' nests, while it does little or no injury to plants with which it comes into contact.

Instances of damage done by these beetles are by no means rare, and Mr. Junor says that they are well known to every farmer who cultivates the low-lying lands of this colony, also that as their lives are short and they have many enemies they never do much damage. All their invasions seem to be of short duration, and the reports of damage done are usually made after the insects have disappeared. Although I have heard several previous accounts of ground provisions being destroyed by them, this is the first occasion on which I have had the opportunity of witnessing the occurrence.

They usually appear on new land which is being cultivated for the first time, and after the land has been under cultivation for a short time and the soil has become drier, the crops growing on the land are no more attacked by them.

In June specimens of the same small Hardback beetle were received from Pln. Nismes with the complaint that they were attacking the young shoots of newly planted canes. A specimen forwarded showed that the beetles had eaten into the cane-tops and had also attacked the bases of the young shoots. As in the previous instance the land had been newly planted, being

formerly an old pasture, and there were no "grubs" to be found. The manager states that the beetles have also been observed feeding on dry cow-dung.

Probably dipping supplies in a solution of chlorc-naptholeum or in lime-wash before planting will prevent them from being attacked. The application of freshly slaked lime around those already planted should keep the beetles away, but the manager says that some plants growing on land which has previously been well limed are also being troubled by the beetles.

Indigenous Cottons from the Rupununni.

In February last samples of six varieties of the cottons cultivated by the Indians on the savannahs in the southern part of the colony and brought to Georgetown by Mr. H. B. C. Melville, of the Lands and Mines Department, were forwarded by the Director of Science and Agriculture to the Imperial Institute for examination.

The cottons were unginned, in one case being still in the bolls, and each sample was packed in one of the ingeniously constructed baskets woven by the Indians from a single fan-palm leaf. Each variety of cotton bore the local name by which it is known to the Indians.

Practically the only use to which the Indians put the cottons is in making the rough cotton hammocks, which are one of the principal objects of barter amongst them.

A report on these has been received from the Director of the Imperial Institute, Professor Wyndham Dunstan, of which the following are extracts :—

SAMPLE 1.—"*Kineabu*," THE COMMON COTTON OF THE COUNTRY.

Brazilian "kidney," variety of cotton.

Lint rather woolly, lustrous, pale cream colour with a small quantity of yellowish-brown stain. Yield on ginning only 23 per cent. ; easily separated from the seed.

Seed in clusters of 6 to 9. Generally smooth and dark brown in colour, occasional clusters invested with a bright green down. All the seeds examined were healthy.

Commercial Value.

About 7d. per lb. with 'fair' Pernam at 6·53d. per lb., and 'good fair' moderately rough Peruvian at 8·50d. per lb. The cotton is of good quality, but slightly depreciated in value by the presence of stained portions ; it would be ready saleable.

SAMPLE 2.—"*Suwad.*"

Probably improved American.

Lint soft, lustrous, even cream colour, generally free from stains. Yield on ginning 29 per cent. ; not easily separated from the seed.

Seed rather large and generally closely invested with a brownish green or green down. All the seeds examined were healthy, and there were no signs of the attack of insect pests.

Commercial Value.

About 8d. per lb. with 'middling' American at 5·68d. per lb. and 'good' Abassi at 10¼d. per lb.

This cotton had probably been grown* from 'improved' American Upland seed. It is of excellent quality and almost approaches Egyptian Abassi cotton in character.

SAMPLE 3.—"*Awintearda.*"

Probably Brazilian.

Lint rather harsh, lustrous, fairly even cream colour, generally free from stains. Yield on ginning 31·5 per cent.; very easily separated from the seed. Seed occasionally adhering in twos and threes, large, generally smooth and dark reddish brown in colour, a few partially covered with a light brown down. Six per cent. of the seeds examined were withered, but there were no signs of the attacks of insect pests.

Commercial Value.

About 7½d. per lb. with 'fair' Pernam at 6·53d. per lb., and good fair' moderately rough Peruvian at 8·50d. per lb.

This cotton is similar in character to sample No. 1, but is of better colour and free from stains; it is of very good quality.

SAMPLE 4.—" *Wisadie.*"

Probably Brazilian.

Lint rather harsh, even cream colour generally free from stains. Yield on ginning 31 per cent.; fairly easily separated from the seed.

About one third of the seeds were of the "kidney" variety occurring in clusters of six to eight smooth seeds; the remainder were single, and covered with a light reddish brown down. All the seeds examined were healthy.

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* It is very unlikely that the Suwad cotton can have been grown from "improved" American seed. As far as can be ascertained it is an indigenous tree-cotton.—ED.

Commercial Value.

About 7½d. per lb. with 'fair' Pernam at 6·53 per lb., and good fair' moderately rough Peruvian at 8·50d. per lb.

This cotton is slightly darker in colour than sample No. 3, but is of very similar quality.

SAMPLE 5.—"*Bisa Tail.*"

Probably Brazilian.

Lint rather harsh, even cream colour, entirely free from stains. Yield on ginning 35 per cent.; fairly easily separated from the seed.

Seeds of medium size and generally covered with a short light brown down; some seeds only partially covered. 8 per cent. of the seeds examined were withered; but there were no signs of the attack of insect pests.

Commercial Value.

7½d. to 8d. per lb. with 'fair' Pernam at 6·53d. per lb., and 'good fair' moderately rough Peruvian at 8·50d. per lb.

This cotton is similar to the preceding sample, No. 4.

SAMPLE 6.—"*Purume.*"

Brazilian "kidney" variety of cotton.

Lint rather harsh, lustrous, even pale cream colour, entirely free from stains. Yield on ginning 25 per cent.; easily separated from the seeds.

Seed of the "kidney" variety in clusters of 5 to 9; generally smooth and dark brown in colour. 8 per cent. of the seeds examined were withered.

Commercial Value.

About 8d. per lb. with 'fair' Pernam at 6·53d. per lb., and 'good fair' moderately rough Peruvian at 8·50d. per lb.

This cotton is of excellent quality, similar to sample No. 1, but is of better colour.

CONCLUSIONS.

These samples of cotton compare favourably with standard specimens of similar varieties, and all of them would be readily

saleable in this country. The "Suwad" cotton, which appears to have been grown from American seed, is of very superior quality and would probably be in greater demand in the English market than the rougher Brazilian types, which, although generally of excellent character, would be somewhat more limited in their commercial applications.

The yield of lint from the "Kineabu" and "Purume" cottons (23 and 25 per cent., respectively), is lower than usual for "Kidney" cotton, which generally furnishes about 28 per cent. All the cottons had been well grown, and there were no signs of the attack of insect pests.

(Signed) WYNDHAM R. DUNSTAN.

19th May, 1908.

Agricultural Shows.

The Victoria-Belfield Agricultural Show was held on the 11th August in the grounds of Sendall Park.

There being no building in the immediate district available, improvised sheds were put up which answered their purpose very well as there was no rain on the day of the Exhibition.

The exhibits of fruits and vegetables were for the most part very good.

In the economics, starches, meals and cassava-bread were in quantity and good, but in other respects the section was weak. Rice was absent altogether.

The effect of the excellence of the fruits and vegetables was greatly diminished by the tables and stages on which they were exhibited. Had these been better arranged there is no doubt that the exhibition would have been declared as the best of the District Shows up to the present.

Fruits:—Bananas were disappointing: only 6 lots all told, and only fair fruit.

Pine apples were small but good. Mangoes, sapodillas and star apples were poor.

Sugar apples as a rule have been poor, but here they were very good.

The Citrus fruits occupied the greater part of the fruits section and made a splendid appearance. Sweet orange, 16 lots; tangerine, 7 lots; seville, 9 lots; lemons, 6 lots; limes, 26 lots; and grape fruit, 9 lots.

Shaddocks and grape fruits were again misnamed, the one for the other. Coconuts were not so good as we are used to see them, only three good lots out of 11.

Vegetables:—Here the roots were splendid specimens, sweet cassava, 21 lots; bitter cassava, 10 lots; tannias, 41 lots; eddoes. 15 lots; yams, 9 lots: better than these have never been exhibited. Sweet potatoes were poor.

Pumpkins were exceedingly good, 11 lots.

The breadfruit was the best seen for many years.

Plantains were fair exhibits, though in much less quantity than was expected. Ochroes, peppers and boulangers were well represented.

Economics :—Meals, starches and cassava-bread were good and in large quantities; sauces, jellies and preserves were of no great account. Pickles there were none. The oils were very bright and clear. Ground nuts made a good show, and were better than we usually see. Copra: of real copra there was none, instead there were broken nuts dried and grated nut.

Cotton 6 lots; one lot was very bright, clean and of good staple.

The Model and School Gardens' produce was generally good and comprised most articles which could be exhibited from them.

In the poultry and cattle there was little to remark except that there were some good cross-bred fowls and a nice pair of white turkeys.

The Board of Agriculture stand was, as usual, a conspicuous object of plants, fruits, economics, canes and fibres.

The West Bank Farmers' Association held its Exhibition at La Grange on the 19th August.

It is to be congratulated on having produced one of the best District Shows ever seen. All the arrangements were well carried out, the stages were all of uniform size and height and the accommodation so well calculated as to contain all the exhibits except the plantains, bananas and canes, which were placed just outside.

The quality of most of the fruits and vegetables was unquestionable, also of many of the economics, especially the cacao and coffee; the quantities of most were large, especially the Citrus fruits. Plantains and bananas might have been better from this district. For the first time shaddocks and grape fruits were exhibited without mistake, the results of visits paid previously by one of the instructors.

The work of the judges was not light with regard to the citrus fruits for there were: sweet oranges, 42 lots; seville oranges, 13 lots; tangerines, 14 lots; shaddocks, 12 lots; grape fruit, 11 lots; limes, 16 lots; and lemons, 20 lots.

Avocado Pears, though they were 18 lots, the half of them were too young.

In the *Vegetables* (root section) was a fine display: buck yams, 9 lots; yams, 10 lots; sweet cassava, 12 lots; bitter cassava, 8 lots; tannias, 25 lots; eddoes, 10 lots; all excellent.

In the *Economics*, Creole coffee and Liberian coffee were 7 lots each; cacao beans, 9 lots; cacao pods, 18 lots; meals: plantain, 6 lots; cassava, 11 lots; starches: arrowroot, 8 lots, cassava, 16 lots; cassava bread, 12 lots; tapioca, 6 lots; jellies and preserves only 8 lots all told.

Oils,—castor, 5 lots; coconut, 4 lots; and crab, 2 lots.

Of Guinea pepper there were 9 splendid lots of seeds and a good basket of fruits.

Cayenne pepper, curry powder and chutnee, 5 lots each; vinegars, banana and mango, 12 lots; cotton, 8 lots.

The School and Model Gardens were well represented in vegetables and salads.

In poultry and cattle the show was rather poor.

The Board of Agriculture had its usual display of plants, fruits and economics, samples of fibres, leaves producing fibres, and samples of seedling canes.

JNO. F. WABY.

Visits of Agricultural Instructors.

Mr. A. A. Abraham paid visits for the purposes of instruction to the West Bank, Demerara, during May.

On 15th May Mr. Abraham addressed a meeting of a number of the Bagotville farmers in the Village Council room and afterwards visited the farms where he gave practical instruction and advice. The following week the cultivations of No. 2 Canal and Good Intent and Sisters villages were visited, and the farmers were again addressed on agricultural subjects.

The farms of Bagotville and No. 2 Canal were found to be suffering from unsatisfactory drainage, especially in the latter district.

Mr. Abraham reports that coffee and cocoa are the principal products grown, but that there is a general absence of systematic methods of planting and a lot of work is required in improving the tillage, drainage, and general cultivation. A quantity of plantains and other ground provisions were also being raised.

Mr. Abraham visited the West Coast, Demerara, on 1st June, and met the farmers of the district in the Village Council office at Den Amstel, and arranged to visit the farms the following week. The promised visit lasted from June 10th to 13th, and included the villages of Den Amstel, Ruby and Farm. Mr. Abraham reports that the cultivations were generally in an unsatisfactory condition owing to the farmers taking up the cultivation of rice. Plantains and cassava were the chief ground provisions grown.

Mr. W. M. Matthews visited Plaisance and Beterverwagting villages during the third week in May and the first week in June. Many of the farmers from Plaisance were working on the neighbouring Sugar Estates, so that he met only a small number of them. He remarks that on most of the beds planting is done in no regular order and that the plants are too crowded together for their proper development and that in many cases the important matter of drainage is totally neglected. He was pleased to observe that many of the beds were kept clean and showed evidence of good tillage. Rice is being extensively cultivated but there was a great scarcity of permanent crops, and Mr. Matthews noticed but one bed of cocoa and here and there a solitary coffee tree.

At Beterverwagting cane cultivation occupied the largest area the farmers finding a ready market for the canes on the neigh-

bouring Sugar Estates. Mr. Matthews observes, "much care seems to have been bestowed on the growing of the canes for there were beds containing some of the finest specimens that I have seen."

Rice comes next to canes in importance and its cultivation is being taken up by many of the creoles.

The plots of ground provisions were generally in a satisfactory condition, and the farmers had allowed their crops more room for their successful growth. Two beds only, belonging to a Portuguese, were planted in cocoa.

The drainage was again found to be a serious drawback, in some cases the depth of the draining trench being less than that of the smaller drains between the cultivations.

Mr. Matthews visited Friendship and Buxton on July 1st and 2nd. In Friendship only one plot of coffee and cocoa was noticed about an acre in area. The soil varies in places from almost a pure clay to sand where reefs occur.

Buxton section is principally cultivated in ground provisions, but there were a few plots of canes. Correct distances in planting are better observed here, and weeding and tillage are in a more satisfactory condition. The cultivations, however, were suffering from defective drainage due to the dirty condition of the side line trenches.

Mr. N. R. King spent a fortnight in Berbice from 15th to 29th June. The first four days were spent in visiting farms belonging to villages on the east bank, where plantains and cassava are the chief products grown, but the cultivation is indifferent and the drainage poor. On 21st the cultivations on the English side of the Corentyne River were visited. Mr. King found several acres planted in coffee and cocoa, but the trees were in a neglected condition and too heavily shaded. On Mr. Frank's grant were several rubber trees belonging to Hevea, Castilloa and Funtumia, all making excellent growth, but too closely planted. The soil along the Corentyne River appeared to be rich.

Mr. King reports that the rice industry has taken a great hold upon the people of Berbice amongst creoles as well as East Indians. In addition to the coast lands the section of Providence known as Overweening is now entirely under rice cultivation.

Mr. Fitz Greeves paid three visits to the West Bank and No. 1 Canal on July 24th and 28th, and August 5th. On the first day he spoke to a number of the farmers in the Bagotville Council

hall and explained to them the best methods of preparing exhibits for the forthcoming Agricultural Show. On 28th Mr. Greeves again visited the West Bank and first of all addressed the farmers in the Council hall about proper tillage, rotation of crops and the mistake of planting too close. Afterwards he visited certain of the cultivations where practical instruction in pruning, planting, etc., was given. Another visit was paid to Canal No. 1 on August 5th for the purpose of visiting the cultivations, and the necessity of good tillage and planting a sufficient distance apart was impressed upon the farmers. Mr. Greeves mentions that on Pln. Onderneeming there are 30 acres under rice cultivation, several young coconut palms, hundreds of orange and other fruit trees, as well as several acres of coffee and cocoa.

Mr. A. A. Abraham spent July and a part of August in the Pomeroon district visiting the cultivations and iustructing the farmers along the river. He reports that the staple products of the district are cocoa, coffee, coconuts, plantains, corn, rubber, rice and cassava, while eddoes, tannias, pumpkins, and sweet potatoes are grown as catch crops. The cocoa and coffee cultivations were mostly in good condition, but in a few cases the Liberian coffee trees are allowed to grow to a considerable height, making the picking of the berries a difficult matter.

Many acres are planted in coconuts and the area is being extended. The trees were generally in a healthy condition and bearing prolifically, some trees producing nuts when only 3½ years old. A quantity of plantains are grown and some fine bunches are obtained. Mr. Abraham remarks on the suitability of the soil and the other conditions for the cultivation of rubber. The bush growing along the edge of the river forms an excellent wind-break. On one farm about 2,000 Sapium Jenmani and 500 Hevea brasiliensis have been planted and are growing well, requiring only some pruning in the manner recommended by the Department of Science and Agriculture.

Considerable areas have been planted in rice within the last year or two. This is to be regretted because comparisons with returns of preceding years indicate that the cultivation of coffee —a permanent crop—is being displaced by that of rice—a temporary one.

Mr. Abraham points out the evils of the present system of the farmers obtaining loans from merchants in Georgetown and elsewhere to enable them to plant rice. The farmers bind themselves to sell their paddy in bags weighing 130 lb. at one dollar per bag whatever may be the market price at the time, until

they have refunded the money advanced and paid the charges thereon, which works out at an exorbitant rate of interest. The merchants have agents in the district who inspect the cultivation and report its progress to them.

The money so advanced is spent in preparing the land and planting the rice, which is not ready to be reaped until six months later. Meanwhile the farmer has to live on credit and often has to buy his provisions from the merchant who has financed him, so that when the crop is reaped the amount of the advance with its exorbitaut interest has to be repaid together with the cost of the articles obtained on credit. Too frequently this leaves a very small margin of profit, if any at all, and a loan has to be obtained for the next planting.

Cassava is much grown and forms the chief food of the labourers and is also used in making starch, cassareep and cassava bread. Oranges, which are plentiful, are practically the only fruits grown.

On 20th July Mr. Abraham attended a meeting at Hackney for the purpose of discussing the lime industry, and gave a short address on the cultivation of limes. At the close of the meeting a resolution was passed according to which the farmers of the Pomeroon bound themselves to take up the cultivation of limes.

At the close of his report Mr. Abraham refers to the marked improvement noticeable in the farms which have been visited on various occasions by one or other of the instructors in Agriculture, and he remarks that these farmers are doing their best to carry out the instruction they have received.

Mr. D. V. Jacobs has paid frequent visits to each of the Model School Gardens under his charge and occasional visits to other School Gardens. At all of these the instruction given has included object lessons as well as practical work in the varions garden operations of tillage, transplanting, etc. Instruction, advice and demonstration lessons have also been given to the school teachers attending the lectures in Agricultural Science.

In addition to the above Mr. Jacobs has taken advantage of every opportunity of imparting instruction to farmers and householders when in the country districts as to the cultivation of farm and garden produce.

On 25th August, the Government Botanist, accompanied by Mr. N. R. King, Agricultural Instructor, started from New Amsterdam and travelled up the Canje Creek for a distance of about 70 miles from the mouth.

There were scattered cultivations for the whole distance but more especially in the lower parts, but very few of these showed any attempts at systematic cultivation.

At Pln. Port Mourant, Mr. Daniels planted 1,000 Hevea brasiliensis along the dams about five months back. Some of these, especially where they were not shaded in any way were making fair growth. The leaves of several of them had been more or less eaten away by some animal.

In the lower part of the Creek the cultivations have suffered very much by flooding owing to the late heavy rains, and most of the crops have been destroyed. On many of these one can now go by boat up to the door of the house.

Most of the grant-holders appear to live a hand-to-mouth existence and cutting cordwood and bleeding balata seem to be their chief occupations, consequently agriculture is very much neglected. The attempts at planting generally consist of a few coconut trees, and some plantains, cassava and sugar cane growing in the neighbourhood of the houses. Where a larger area had been planted this was mostly overgrown with weeds, for which the heavy rainy weather is partly responsible. We were almost unable to obtain any fresh provisions except at one place where we purchased some cassava and yams and a bunch of bananas, and at another place a bunch of very young green plantains.

A pleasing exception was found at Mr. Harry's grant which lies by the Manarabisce Creek, and where we stopped for the night both going and returning. Five or six acres were under cultivation in various crops. There were a number of coconut trees which were planted far too close so that the leaves were interlacing, and although the trees looked healthy yet none of them bore many nuts.

The soil is a sandy loam and appears to be of much the same nature along the Creek as far as we went.

The rest of the area is occupied with plantains and cassava, and there are several coffee trees which needed pruning. A number of orange trees were looking very healthy.

The only other cultivation of any interest or importance which we saw was Richmond Hill which lies along the Icuruwa Creek, about 55 miles distant from the mouth of the Canje Creek. Here there are about 30 acres planted in coconut palms about 50 to 60 years ago. These are some of the tallest trees I have seen and most of them were heavily laden with nuts, some of the

palms being said to yield as many as 100 to 120 per annum. As the name of the place signifies, the trees are growing on a hill, and their great height allows them to enjoy the breezes from the coast, as there is no higher vegetation in between. I think that this fact, altogether with the soil being a sandy loam, explains why the palms are flourishing at such a long distance from the sea-coast The palms also have generally plenty of room for their branches to spread without any interference with each other.

Board of Agriculture.

A meeting of the Board of Agriculture was held in the Court of Policy Hall, at 2 p.m., on Wednesday, 22nd July. His Excellency the Governor presided. The other members present were Professor J. B. Harrison, Hon. B. Howell Jones, Hon. R. G. Duncan, Hon. C. P. Gaskin, Rev. F. C. Glasgow, Messrs. Wood Davis, F. Fowler, A. W. Bartlett, J. Brummell, J. Junor, J. Monkhouse, and Dr. J. O'D. Egan.

The following were some of the principal matters considered:—

The Report of the Government Nominee on the finances of Essequebo Agricultural Show, showed that a balance of $68 51 remained unexpended from the Government grant.

Professor Harrison said that 26 prizes amounting to $16 56 were won by the four Model School Gardens at the Show. The value of the prizes obtained by the other School Gardens was over $40, including some open prizes as well.

A leaflet from the Imperial Department of Agriculture describing the principal fungus diseases of cacao was laid on the table.

Local Woods for Puncheons.

Professor Harrison said that some of the members had drawn attention to the possibility of some of the local woods being used in the manufacture of puncheons for exporting rum. The late Colonial Civil Engineer had some puncheons made but they would not retain spirits or water. It appeared that the local woods were not suited for the purpose.

Mr. Howell Jones said that the chief objection was that the wood used gave a flavour to the rum, but the puncheons might be employed for holding molasses. Many woods had been tried from time to time and there were one or two men still working at the subject.

His Excellency remarked that he had been informed that there was a difficulty in obtaining puncheon staves, which Mr. Jones confirmed and said that they were obliged sometimes to use second-hand puncheons. In some cases these were better because new puncheons often discoloured white rum.

Hon R. G. Duncan stated that Mr. G. R. Garnett had a puncheon made out of greenheart and filled with rum and this had been sent to the London market and they were awaiting a report on

it. The greenheart puncheon was rather heavy and they were afraid it might flavour the rum.

His Excellency said that the experiments in puncheon making at Christianburg ought to be continued as there were all kinds of woods to experiment with, and that he would issue instructions accordingly. He stated that there were complaints of leakage of rum from second-hand puncheons and they were asked to remit the duty on the rum lost.

Mr. Duncan estimated that at least half the rum was shipped in second-hand puncheons.

Mr. Gaskin suggested offering a valuable prize to encourage people to find a suitable colony wood for puncheons.

RUBBER.

A Report by the Commissioner of Lands and Mines, on a visit to the Isoorora Rubber Station, was read by the Secretary.

Professor Harrison said that he visited the Station shortly after with Messrs. Ward and Waby and the question of pruning was discussed. He came to the conclusion that it would be useless to attempt growing rubber on unempoldered or undrained land. Water about the roots of Sapium caused the trees to lose all their leaves which would mean keeping back the growth of trees for six months of the year. Messrs. Waby and Ward had drawn up a set of directions for the pruning of young rubber trees.

In reply to a question by Mr. Duncan, Professor Harrison said that Sapium grew on land which was a little higher than the rest and just out of the swamp.

Mr. Duncan asked whether it was known what yield of rubber a full-grown Sapium tree gave?

His Excellency thought that it was important to ascertain the yield of full-grown trees and suggested to Mr. Fowler, the Commissioner of Lands and Mines, that this might be tried on a selected piece of Crown Lands where several Sapium trees grew.

Mr. Ward said that while he was in the North-West he tried tapping a Hevea brasiliensis planted by Mr. Im Thurn 13 years back and a Sapium of 11 years old. The Sapium gave half as much rubber again as the Hevea.

His Excellency said Mr. Anderson had been instructed to make enquiries as to the yield of the trees and also the means of coagulating rubber and would soon be able to furnish a report.

Reports on Cotton.

Professor Harrison said that he had sent five samples of cotton, they had been continuing to grow at the Botanic Gardens to the Imperial Institute and a report upon them had been received. Caravonica cotton had been valued at 8½d. and 9½d. per lb. A sample grown from selected seeds of Mitafifi was valued at 9½ per lb. whilst a sample grown from the original seed and sent at the same time was valued at 7½d. per lb. It was satisfactory by selection that the yield per acre of Egyptian cotton had been doubled and the value had increased from 7½d. to 9½d. per lb.

A report had also been received on 6 indigenous cottons from the interior, which had been valued at from 7d. to 8d. per lb. One of these valued at 8d. per lb. was said to be of excellent quality and resembling the Egyptian Abassi in character. This showed that amongst the wild tree cottons indigenous to the colony there were good varieties to fall back upon.

Mr. Bartlett had raised several hybrids by crossing the Buck with the Sea Island cotton and plants were growing in the Brick-dam field. The hybrids had far greater vigour than the Sea Island while they took on the early flowering character of the Sea Island.

Onderneeming Farm.

Referring to a report on his visit to Onderneeming, Mr. Howell Jones remarked on the admirable conditions of the cultivations aback and on the very great improvements on what he had seen on a previous visit. Most of the shade trees had been removed from the cocoa and the trees themselves were coming into blossom very satisfactorily. He felt certain that in a few years the trees would yield equal to cultivations in Trinidad and Grenada.

Experiments with rubber showed that the trees, like every other plant except aquatic plants, would not grow successfully without drainage.

He also spoke about the satisfactory way in which rubber trees were growing on Pln. Hope in flat alluvial soil.

His Excellency expressed the hope that other members of the Board would take the opportunity of visiting Onderneeming with Professor Harrison.

Sales of Economic Plants.

Referring to the return of sales of economic plants at the Botanic Gardens stall in the Stabroek Market, Mr. Bartlett

said that the average daily number of plants exposed for sale during April was 161, during May 231 and June 254. From 1st April to 30th June, 1,312 plants had been sold and the receipts amounted to $40 81. The principal plants sold were cocoa 266, coffee 235, nutmeg 89 and sweet orange 87.

Professor Harrison said that the Hon. C. P. Gaskin had written to him, suggesting the establishment of a stall in the New Amsterdam Market. He approached the Governor and His Excellency had approved of the idea being tried for three or four months and had authorized the necessary expenditure If the sales justified the experiment the stall was to be continued, and a specific vote for its upkeep would be asked for future years.

Hon. C. P. Gaskin said that the Mayor and Town Council would be willing to give a stall free of charge, and the Market Clerk would look after the selling of the plants, so the only cost would be the freight on the plants.

His Excellency decided that the same prices should be charged for the plants in New Amsterdam as in Georgetown.

Returns of Areas under Cultivation.

Professor Harrison spoke about the increasing difficulty that there was in getting correct returns of the areas under the various cultivations other than sugar-cane. Within the last two or three years the people were unwilling to give the information and the figures were wanting in accuracy. The question was brought before the Board to obtain the opinion of the members as to the advisability of legislating so as to compel the people to furnish correct information as to the area under cultivation. It was important to know the area under the different kinds of cultivation and whether it was increasing or decreasing, so as to be able to supply the information for the various Government publications.

Hon. R. G. Duncan said that the people were under the misapprehension that the Government wanted to obtain the acreage under cultivation so as to impose a tax on them.

Rice Industry.

Continuing, he said that the rice industry was an important one but the people were not getting the full benefit from it because they did not grow the rice as they ought to do. It was a mistake to plant two crops in a year, and the result was

that neither was good. They were in a hurry to reap and plant again so that they did these out of the proper seasons and lost one crop through absence of a water supply or got poor returns.

He thought that there ought to be a proper time to plant the crop, and this should be shown to the people by the Agricultural Instructors. On the other hand if it was through want of care instead of knowledge the people ought to be made to plant at the proper time, because it would be to the people's benefit and the benefit of the colony that the area should yield as large an amount as possible.

Professor Harrison said that the time of ripening depended upon the variety grown, and the one that had the longest growing time produced the smallest crop. He thought that one of the Instructors might give special attention to the matter and inquire into the reaping and growing time, as there was some difference of opinion in the matter. When two crops were tried one of them was usually a failure.

Mr. Duncan said that most of the people planted creole rice which took six months to mature. They often planted in the dry season when there was no water.

His Excellency thought that the Instructors should visit the different districts to hold meetings and inform the people as to what should be done. He suggested the formation of a small Committee to consider the matter,—Professor Harrison, Messrs. R. G. Duncan, J. Junor, J. Monkhouse, Hon. B. Howell Jones, and Mr. Bartlett as Secretary.

Sugar Cane Experiments.

With reference to the conduct of Sugar Cane Experiments by the Department of Science and Agriculture, Professor Harrison said that the papers had already been circulated and were the answers from all the sugar estates in the colony to the criticisms on these experiments.

Mr. Duncan suggested that a concise summary of these might be published, and His Excellency approved of this course.

Expenditure on Nursery-Ornamental.

In reply to a question which had been asked at the last meeting of the Board as to the expenditure at the Botanic Gardens on "Nursery-Ornamental," Professor Harrison said that statements of expenditure and receipts had been prepared which

showed that the greater part of the money expended had been returned in the sales.

Apprentices.

Speaking of the Apprentices, Professor Harrison said that two had been already indentured, another was going to be shortly, and another was on a longer probation. He hoped to have four apprenticed during the year.

Live Stock.

Professor Harrison stated that the Committee had decided to import their live stock from the Southern States of America, which course had proved satisfactory.

The Secretary read a letter from Mr. Meaden of the Government Stock Farm in Trinidad regarding the proposal to exchange stallions. While the idea was described as excellent, it was thought that nothing was to be gained by either side by the exchange in view of the ages of the stallions.

Selected Contents of Periodicals.

The Journal of the Board of Agriculture, London.

"Breeding and Rearing of Turkeys," Vol. xv., No. 5, p. 340, August, 1908.

Tropical Agriculturalist.

"Hints for Tobacco Growers," Vol. xxx, No. 4, p. 322, April, 1908.

"The Sisal Fibre Industry in Queensland." Do. p. 327.

"Camphor Cultivation in Ceylon." Do. p. 346.

Proceedings of the Agricultural Society of Trinidad and Tobago.

"Scale Insects," Vol. viii, part 6, p. 245, June 1908.

"Shade or no Shade," (Cacao) Vol. viii., part 8, p. 337, August, 1908.

West Indian Bulletin.

"Varieties of Sugar Cane and Manurial Experiments in British Guiana," Vol. ix., No. 1, p. 1, 1908.

Central Agronomic Station, Cuba.

"Propagation of Tobacco in Cuba," Bulletin No. 10, February, 1908.

Agricultural Research Institute, Pusa.

"Report on Coconut Disease in Travancore," Bulletin No. 9, March, 1908.

Agricultural Bulletin of the Straits & Federated Malay States.

"Cultivation of Pepper in Sarawak," Vol. vii., No. 6, p. 189, June, 1908.

The Porto Rico Horticultural News.

"Tobacco Growing in Porto Rico," Vol. i., No. 1, p. 6, July, 1908.

"Pine-apple Growing in Cuba," Vol. i., No. 1, p. 13. July, 1908.

Louisiana Planter and Sugar Manufacturer.

"Use of Formaldehyde Solution in Sugar Mills," Vol. xli., No. 8, p 122, August 22, 1908. (Reprinted from "Hawaiian Planters' Monthly.

Bulletin of the Imperial Institute.

"Cultivation and Utilisation of Annato," Vol. vi., No. 2, p. 171, 1908.

The Philippine Agricultural Review.

" Manioc or Cassava," Vol. i., No. 4, p. 139, April, 1908.
" Practical Suggestions on Poultry Raising." Do. p. 157.

Natal Agricultural Journal.

" Poultry Keeping in a Simplified Edition for Farmers," Vol. xi., Nos. 6 and 7, pp. 695 and 844, June and July, 1908.

These papers may be obtained on loan by persons authorised to use the Library of the Board of Agriculture.

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Small Holdings and Small Holders.

Experience has taught the inhabitants of British Guiana to look with a very cautious eye at attempts to import legislation direct from England into the colony. Circumstances alter not only cases but the incidence of laws; and it does not follow logically that an Act which may be regarded as a triumph of wisdom and experience in the Old Country will prove even a modified success when brought to bear on an isolated community lying on the borders of the Empire. Nevertheless—the proviso being borne always in mind—much good may accrue from a careful consideration of what is being done in England, especially in things agricultural. Take the Small Holdings Act, for instance. It is not to be supposed that its adoption by our Government would solve at a stroke our "Back to the Land" problem, but more than one useful hint can certainly be obtained from a thoughtful following of its provisions and practice.

A "small holding," for the purposes of the Act, is defined as an agricultural holding which is more than one acre and (except in certain special cases) not more than fifty acres in extent; and the local authorities directly responsible are the County Councils and the Councils of County Boroughs, which have power to acquire land, compulsorily if necessary, to borrow money *ad hoc*, and to sell or let land to approved applicants or associations It is clear that in a country of limited extent like England, where land is in great demand and is already all taken up, the first two of these provisions are most important locally, though they have little concern for British Guiana where the circumstances are precisely opposite; but the third is in an entirely different category. So much of the success of such a scheme depends on the character of the applicant that the conditions laid down for his selection are worthy of more than a passing notice.

Now there is no restriction in the Act as to the class or sex of persons who may apply for small holdings; but it is stipulated that they must "themselves cultivate the holding." Yet this expression is not to be interpreted in a narrow sense. For the purposes of the Act "cultivation" has been defined as the "use of land for any purpose of husbandry including the keeping or breeding of live stock, poultry or bees, and the growth of fruit, vegetables and the like." Hired labour to assist in the cutivation is not to be excluded, nor are persons who acquire land as an adjunct to their present occupations to be refused on that account nor are their applications to be given a secondary place as compared with those of men who propose to devote the whole of their time to their holdings. But, except in the case of a sitting tenant, there is no provision for the advance of money out of public funds to individuals taking up small holdings. Further, Councils have to satisfy themselves by means of enquiries conducted at personal interviews that the applicants are "suitable persons": and one of the essential qualifications is that intending holders shall have sufficient experience and means to work their property with the prospect of success. To him who finds grace in the eyes of the examining board (so to speak) the terms of purchase are definite but easy:—one-fifth of the money down, one-fourth as a perpetual charge upon the holding (if desired), and the balance, with interest, in half-yearly instalments spread over a period of not more than fifty years. One precaution is, however, taken: conditions are imposed which ensure that the holding will not be diverted from the purposes of agriculture. With this few will be found to quarrel. It is no part of the duty of a Government to encourage land speculation, even in a small way.

We must confess that this personal selection of candidates appeals to us as a wise and politic measure, and one worthy of adoption in any similar Small Holdings scheme which may be introduced into this colony. It seems so eminently calculated to stall off the shallow enthusiast who is the curse, and potentially the certain ruin, of every land settlement proposal. The great agricultural revival which has marked these early years of the twentieth century has done much good; the "Return to Nature" cry represents, we believe, a very salutary reaction from the artificiality of town life and a quite legitimate revolt against the ever-growing burden of industrialism; but it has not always been happy in its exponents. To convert a born townsman into a decent agriculturist is no easy task. The quick play of urban life fosters a corresponding quickness of intellect, a "smartness" which often marches perilously near the borders of dishonesty, a fatal facility for "chucking up a job" which has become tem-

porarily irksome and seeking that "other employment" which may lie so temptingly close at hand. The agriculturist must be dogged and persevering. His work is physically laborious, his reward slow in coming; and even to the transplanted city man honestly eager to make the best of his holding will come the time of depression when he will despair of success and hanker after the flesh-pots of the life he has quitted. Then it is that the conditions under which the land is held will be put to the test and the wisdom of the framer tried. If the holder has had to pay good money for his land, if his savings are sunk in the soil, it is probable that he will "hang on" or "sit tight" or take the manly course by whatever phrase it be called. If the committee which chose him paid due regard to grit and determination as qualifications when examining applicants, he will most certainly do so. If, on the other hand, the holding has cost him little or nothing, if the taint of charity has been over it all, if no discrimination has been shown in the selection of the holder himself, the easily-acquired grant will be surrendered like a worn-out toy and the disgusted amateur will return to the town to resume his old habits and to advertise loudly—if only to justify his own defection—the "Failure of the Scheme!"

This, then, is the hint we gather from the Small Holdings Act now in operation in England:—Examine your applicant personally, satisfy yourself that he is not a "waster," and then make him pay such a sum as will ensure that his personal interest will always lie in his holding on to his holding. The amount of money may be small actually, but it must be large proportionally. Let the anchor which binds the "small holder" to the soil be his own money, and let the cable be self-interest; and then nothing but a genuine hurricane of adversity will cause the tackle to give and the ship to drift to destruction on the rocks which lie so dangerously under the lee.

The Radical Cure of Infectious Plant Disease.

Travellers on the East Coast railway can hardly have failed to notice the unhealthy appearance of many of the coconut trees which form so conspicuous a feature of the district from Mahaicony onwards to Belladrum. The drooping leaves, the yellow crowns, the "bare poles" of dead palms in too many cases point to disease of a wide-spread and malignant nature. The exact cause of the trouble seems still to be determined, but a report on a parallel state of things in Travancore, submitted to the Board of Agriculture of this colony at its last meeting, would appear to indicate that the source is to be found in a fungus (*Botryodiplodia*) which attacks the roots, causing "root-rot" Mr. F. A. Stockdale has described a similar and perhaps identical fungus as the cause of a serious coconut disease in Trinidad, and although proof that the *Botryodiplodia* is the cause of the complaint in both Travancore or in Trinidad may not be absolute, there is a significant similarity of symptoms in all three cases.

The first indication that something is wrong is the opening out of the external leaves from the head. The leaf stalk becomes slightly flaccid and the weight of the leaves causes the whole to droop. Then the ends of the pinnae at the extremity of the leaf become limp and hang down almost vertically. This is accompanied by a loss of colour, and eventually the drooping and discoloration of the leaflets extend backwards to the whole organ. Later the tips of the leaflets turn yellow and dry up, followed gradually by the whole leaf, which at last hangs down withered from the crown. One after another, or many together, all the leaves are similarly affected; and intermediate stages are common. As the palm weakens the new leaves that are put out are smaller than of old. The central or leading shoot becomes stunted and pallid; later on it begins to wither, and the upper free part turns brown. Even in the first year or two the nuts are affected. They are fewer and smaller than usual. The white kernel is shrivelled and hardened, and the copra may be deficient in oil. In later stages a large proportion of the nuts drop in an immature condition, and in some the palm may become entirely barren.

These symptoms point to a grave disturbance of nutrition; and it is not surprising to find that the primary damage is in the roots. No dangerous parasite had been discovered on the stem or leaves; but the root system is extensively involved. The lateral roots are rotted, and in some cases this condition extends back into the main roots and to the base of the stem. Even on

sound roots, perhaps fifty per cent. of the rootlets will be dead. And in the tissue of the affected roots is found the mycelium of *Botryodiplodia*, killing the thin-walled cells of the cortex, destroying the function of the organ—which is to supply water and essential plant-foods to the "laboratories" in the leaves—and setting up decomposition or "rot."

Such are the complexion, the course, and the cause of the disease in Travancore as set out by Mr. E. J. Butler, M.B., F.L.S., the Imperial mycologist, and resemblances to the symptoms among the coconut palms of our East Coast districts will be recognized. The cure is not so easily formulated. The destroying of all diseased material to prevent the infection of healthy palms, ridding the infected soil of the parasite in order to allow of replanting, the application of manures to the roots of the palms, and improving the general health of the trees, are all discussed in the pamphlet under consideration, and a hint is given that the search for a disease-resisting variety might result in an invaluable find. So far, however, practical benefit seems to have been derived only from an application of slaked lime to the roots of the palm; and even in the case quoted the improvement was but temporary. Research is necessary. It is possible that the application of lime or some other substance to the roots may, by destroying the parasite in the soil, enable the new roots that are put out to escape attack. A small garden with sufficient moderately diseased palms for experimental purposes might be taken up and a series of trials planned with the ordinarily available manures, supplemented by ammonium sulphate, lime, sulphur, and sulphate of iron; tested separately and not in combination.

Thus Mr. Butler; who, further, expresses the opinion that on the first appearance of the disease in any quarter the Government agricultural officers should take prompt steps to have infected trees dug up and burned. The owners, he admits, will naturally oppose this measure, as the palms continue to yield for a few years after they contract the disease, and of course have a certain monetary value. Yet, he adds, even where a whole garden or a group of gardens is found to be affected, the interests of the few should be sacrificed to those of the many. Compensation, if required, would not be excessive; but compulsion he would adopt without hesitation.

Compulsion—that is the crux of the question, here as in Travancore. How long are careless or ignorant cultivators to be allowed to infect their neighbours' land from their diseased and neglected plots? How long are centres of virulent infectious

plant disease to remain undisturbed before Government can step in and say, "This thing shall not be!" It depends, we imagine, on the rate of growth of an enlightened public opinion. Constitutional Governments cannot move much in advance of their subjects; hence the not uncommon sighing for the blessings of a benevolent despotism. A readiness to submit to discipline is as characteristic of a civilized community as of the educated individual; and it is a question whether the time is not approaching when, on representations from the appropriate committee, the Board of Agriculture should be able to compel cultivators, in their own interests, in those of their neighbours, and in those of the colony, to take action with regard to the control of plant diseases and insect pests. Then, and not till then, will it be possible to substitute the radical cure of such troubles for what must be, in the present state of things, but a partial and ineffectual compromise.

Notes.

THE TAPPING OF SAPIUM JENMANI.

The first experimental tappings of *Sapium Jenmani*, the most promising native rubber tree of this colony, have been made, and the results reported on by the Forestry Officer (Mr. C. W. Anderson). As the full details have already appeared in the "Official Gazette" it is not necessary to reproduce them here, but some points of interest may be noted.

The place selected for the experiments was a piece of Crown land at the mouth of the Bonasika Creek, near Fort Island on the Lower Essequebo, distant some four hours journey by steamer and boat from Georgetown. Rubber trees had previously been reported as growing wild at the spot, and on further investigation forty-one Sapiums, varying in girth from 16 inches to 92 inches were located within an area of 11 acres. Evidently the place had once been the site of a sugar factory, probably in Dutch times, and that fact should, as suggested by Mr. Anderson, be a clue to the age of the second growth of forest now covering the land. The search among the records of the Department of Lands and Mines should prove an interesting inquiry.

The character of the plot selected was swampy, and, as might have been expected, the rubber trees appeared to grow best on the higher portions, leaving the Manicole palm (*Euterpe edulis*) to revel in its favourite marsh. The tappings extended over a period of sixteen days, and were made with the object rather of ascertaining the comparative yield of the trees by different methods than the maximum yield, with the risk of injury. Of the systems tried, the long (oblique) V-shaped incisions gave the best results, followed by the semi-spiral, the herring-bone, and the full spiral, in the order named. An angle of 70° to the horizontal was found to be the most practical inclination for the cuts, and the "Safety Tapping Knife" proved the most effective and suitable tool for bleeding purposes. Two of these are needed, remarks the Forestry Officer: one to cut on the right hand, and another shaped for the left hand. The Para Chisel proved useful in re-opening and paring the lower edges of the incisions for a second flow, and the Bowman-Northway Pricker was used with great advantage, in certain cases producing a copious second flow when used after the first tapping made by knife only.

Generally speaking, all the eleven trees actually operated on showed signs of exhaustion, and required a rest to recuperate at the finish. In a few cases re-tapping was almost as

productive as at first, but the yield from the majority of trees rapidly declined to little or nothing in the subsequent tappings, and the absence of "wound response" was very noticeable. The slowness with which the latex coagulated in the cuts made it impracticable to tap at intervals of less than two or three days. Two trees were so small (16 and 24 inches in girth) that they gave only one ounce of rubber between them, and their produce is not reckoned in the average returns! but of the nine others, which varied from 32 inches to 92 inches in girth, the average yield per tree for four tappings was 8·33 ozs. or about ½ lb. of dry rubber, of which 5·23 ozs. was obtained from latex collected and 3·1 ozs. from scrap. The average girth of the trees tapped was 57·6 inches, and the average yield per inch of girth 0·144 ozs., or about ⅐ of an ounce. The important fact that 63% of the yield was in the form of good, dry, "biscuit" rubber would appear to be sufficient evidence to controvert the common report that Sapiums give only "scrap." The report concludes with a strong recommendation that the Bonasika plot should be made an Experimental Rubber Station; and, as will be seen from our account of the meeting of the Board of Agriculture on another page, this suggestion has been favourably considered by those in authority.

TOBACCO IN IRELAND.

While the successful growing and curing of tobacco on a commercial scale is still to seek in British Guiana, it seems strange that the business should already have been taken up seriously in Ireland. For the last seven years tobacco has been grown in "the distressful country" and, to judge from a report in the October number of the Journal of the Board of Agriculture (England), not without promise of considerable profit in the near future. The experiments have been conducted on a commercial scale; curing and "finishing" have been done as well as the mere growing of the leaf; and the conclusion has been reached that, as to yield, tobacco is a fairly certain crop in Ireland upon suitable soils in sheltered situations There is apparently a "very narrow margin of growing weather for certain varieties," but little risk from frost; and the marked humidity of the climate is of distinct advantage in ensuring that sufficiency of moisture which is so prominent a factor in determining the class of tobacco All the principal types of the American article have been raised, and, in 1907, two distinct varieties of Turkish—Lataki and Samos—with encouraging results. In spite of the difficulty of its cultivation, even standard "cigar wrapper" has been produced, though the cost of making

"cigar filler" in Ireland is out of proportion to its quality. To sum up an informing report, which is of interest to this colony, the seeds are germinated in glass covered hot-beds; planting is done from May 20 to June 1; harvesting occurs from August 1 until frost; and the "sweating and ageing" which is done "naturally" in warm climates, is affected artificially. All recognized systems of curing have been tried, and a new plan involving forced ventilation has been tested. There does not appear to be any difficulty in obtaining a yield of 1,000 lb. an acre, and in 1907 an exceptional case gave one ton per acre. The cost of production was high—£20 per acre—and the price realized varied from 2½d. to 8½d. per lb. The report ends with this comment:—"The operations to be performed in the cultivation of tobacco can be speedily learned, though a certain horticultural skill, which is not possessed by the average farmer, is required. The curing and finishing for market, however, involve a number of complicated processes demanding technical skill of a high order, which can be acquired only by men of considerable intelligence, and which is not to be expected among farmers generally"—a conclusion which, being the result of experience, is not without value.

Insects' Enemies.

When an insect collector preserves all his captures from any particular locality he is sure to find evidence of parasitism as a means for preserving the balance of Nature. If the average of pests to each plant is six, there is at least an equal number of enemies to every one of them. These enemies are found everywhere, and though in many cases we have not yet identified the particular host of a parasite, we know that its presence has a meaning. Agriculturists generally know that birds, lizards, frogs, fishes and certain classes of insects are useful for keeping down pests, but few are aware that thousands of parasitic ichneumons, chalcids, and flies are continually on the watch to find larvæ in which to deposit their eggs.

In the Year-Book of the U. S. Department of Agriculture, Mr. F. M. Webster has written on the "Value of Insect Parasitism to the Farmer," and although this is of value primarily to the people in the United States it is also suggestive to us. Efforts have been made to introduce the parasites of the pests of economic plants, but as yet without very much success. Mr. Webster remarks that the earliest efforts were crude and bungling, and that the tasks set were difficult and required long, patient, exact, and faithful investigations. He is inclined to think that though a little good has apparently resulted, this is due rather to

natural causes than the preventive measures adopted. Apart from man's interference, when a pest becomes plentiful its enemies increase; it is simply a case of increased food supply; then as the food becomes scarce (i.e., the pest gets killed off) the parasites are starved and become fewer, giving an opportunity for the pest to increase again into the proportions, perhaps, of a plague.

Although the general results are well known, the life history of most parasites is obscure. We have not yet much light on tropical insects, and therefore cannot tell why the cane moth (*Castnia licus*) was so plentiful here five years ago while now it is hardly seen. There is work for the entomologist to find out its enemies. Again, the palm butterfly (*Brassolis sophoræ*) was a pest some time ago, but is not so bad at present. Last year was rather bad for insects, possibly because the rainy season was prolonged and the dry season very short. Examples of insects affected by fungus have been common. Butterflies were less numerous than usual in August and September; in fact the whole year has been marked by a scarcity of insects. Even the October mosquito season was not so pronounced as usual; the explanation being, perhaps, that the savannahs did not run dry. The usual course is for the water to flow from the savannahs to the creeks in the dry season, taking the fish with it. These being natural enemies of the mosquito, the larvæ multiply without hindrance in their absence and a multitude of the insects comes to perfection. The rains of this year probably helped the fishes to remain and feed on the larvæ, and so keep the pest down.

Wet seasons are favourable to some insects, but as a rule we see more species when the meteorological changes are well pronounced. Certain hawkmoths appear to lie dormant in a drought, while other moths and some butterflies seem to be delayed in the pupa stage during heavy rains. The former will come out with the rains, the latter when they cease. Land breezes bring fresh insects to the coast, while "the trades" drive others to the bush for shelter.

Every farmer should know something of the pests to his cultivation. Without such knowledge he may destroy his friends. He may perhaps collect caterpillars, and, noticing certain insects hatch out when they complete their pupa state, rush to the conclusion that these are his enemies whereas they may be in reality the parasitic enemies of the particular caterpillar in question. In breeding insects we often get twenty or thirty parasites from one pupa; these, if left to go free, might kill a hundred of the pest. Similarly gardeners will destroy lady-birds and lace-wings which are helping to keep down the scale insects.—J. R.

Two Cotton Pests.

The Department of Agriculture in India has lately published two "Memoirs," which are of interest to agriculturalists here. The first is on the Red Cotton Bug (*Drysdercus cingulatus*) one of the well-known cotton stainers of which we have several species among our pests. These insects feed on the cotton boll, and by sucking the juice prevent it from maturing. Other plants of the mallows family are also attacked, and experiments were made in India to find out whether something might be grown near the cotton to attract them and reduce their ravages. When the ochro was grown, "the red bugs gathered in quantity on the green pods of this plant and left the cotton; it was very easy to collect all the insects." This suggests that borders of ochroes round a cotton field may also prove useful as traps here as well as in India. Experiments in spraying showed that weak solutions did not kill the pest, and if very strong the insects were killed but the plants suffered. The only effectual method of getting rid of the bug was to collect by hand, striking off the insects into a "winnow" (sieve) and dropping them into a can of kerosene.

The other insect is the Cotton Leaf-roller (*Sylepta delagata*) of which we have a specimen in the Museum, but without record of its life history. It is a pretty Pyralid moth of a yellowish-white colour, the wings striped and spotted with pale brown. Probably it feeds on cotton here as it does in India. Like other leaf-rollers its work may be recognized in folded leaves, under which the larva may be seen when the fold is opened. The larva is semi-transparent, yellowish green, with a brown head. No treatment by spraying is effectual as the curled leaves protect the larvæ, but the removal of the leaves is not difficult, as they are so easily detected.—J. R.

Sugar-Cane in the Colony.

Comparative Figures.

The official report of the Sugar-Cane Experiments Committee of the Board of Agriculture has been published, and in it Professor Harrison gives instructive figures relating to the two crops of the year ended Dec. 31st, 1907, on 31 plantations which carried on trials on a large scale and placed their results at the disposal of the Board. A brief summary of these tables only is possible in the space at our disposal; fuller details may be obtained from the report itself.

Much care has been taken to render the results reliable, and the records included in the report are those only which the Committee considered accurate. Returns relative to the average yields of the varieties in tons of cane per acre are excluded as the divergence in size of the punts used on estates introduces a factor of unreliability. No record is made of small-scale experiments for the purposes of the report, though the Director notes that the results in many of those cases were interesting.

As regards the area reported upon, Bourbon still leads with 15,279 acres yielding 238,52 tons of commercial sugar made. The seedling D 109 comes second with 7,434 acres and 12,353 tons, and D 623 third with 4,508 acres and 7,754 tons of sugar; while the number of trials reported on these two was 52 and 49 respectively, as against 31 for the Bourbon. Sixteen trials of 208 B were reported on 2,786 acres, and the yield is given at 6,762 tons of commercial sugar made, thus coming fourth in the list. Taking the mean yields deduced from the returns—the average of the experiments as plant canes or ratoons with a variety on a plantation during each crop being regarded as a unit—and the "true average" yields of commercial sugar in tons per acre, D 130 heads the list with a mean of 2·30 of and an average of 3·00 with Bourbon giving the figures 1·53 and 1·51 respectively, 208 B 1·72 and 2·43, D 109 1·56 and 166, and D 145 1·72 and 2·11. The Director remarks in this connection that though the "mean yields" do not represent the actual yields per acre obtained (the areas of the experiments varying greatly), yet as they are affected more by the locality of the experiments and less by the area in one locality than are the true averages, they are, in his opinion, the more reliable guides to the relative general values of the varieties.

In order to carry out the recommendation that the records should be grouped so as to show the differences in yields resulting

from differences in soil and meterological conditions, returns are presented in tables showing the average yields of the varieties on each estate grouped under the heads 1) Essequebo, 2) West Demerara, 3) Demerara River, 4) East Demerara 5) West and and East Berbice, and 6) Berbice River; and, compared with Bourbon taken as 100, the yields of the more important of the varieties show the following results:—

	Essequebo.	W. Dem.	Dem. Riv.	E. Dem.	Ber. Riv.	W. & E. Ber.
B 109 ...	163	118	79	—	—	118
D 625 ...	148	105	110	123	89	119
D 145 ...	122	108	128	105	155	117
B 208 ...	101	108	135	122	—	104
D 109 ...	144	113	108	102	104	90

The data supplied are analyzed exhaustively in a series of lucid tables which deal not only with the last two crops but sum up the results obtained from the commencement of the records in 1901; and the milling qualities and the fuel (megass) values are clearly set out. In the latter connection the Director notes that with the exception of the Bourbon and the Green Transparent all the varieties were commented on unfavourably by some of the managers dealing with them.

In another table the varieties are arranged in the order of the saccharine strength of their juices as shown by the means of the contents of saccharose in pounds per gallon during the four years 1904—07; and the means of the quotients of purity, of the quotients of non-sugars, and the recovery of commercial sugars per cent. of indicated sugar in the juices of the varieties are also given. In this last respect, D 116 shows up well with 88·0 %, followed by 208 B with 87·6 %, 147 E with 87·5 %, and White Transparent with 86·3 %. The records prove that the relative order of the canes when classed by means of the saccharine strength of their expressed juices is very similar in the factory trials and in the plot experiments conducted by the Committee.

Some remarkable varieties—judged by their yield in tons of commercial sugar per acre—which have as yet been cultivated only on a small scale, are noticed. Thus "Diamond 185," with an average of 3·15 tons of cane per acre, gave a yield of 173·1, (the yield of Bourbon on the same estate being taken as 100), D 4191 gave 2·60 and 142·8, D 130, 2·30 and 140·2, D 1896, 1·95 and 131·7 and "Lahaina" 2·36 and 130·7.

Summing up, the Director takes the view that the experiments indicate that many varieties of sugar-cane can be relied on in British Guiana to give yields of sugar in quantities equal to or greater than those obtained from the Bourbon. D 625 and D 145 can be safely recommended for trial on relatively heavy lands, whilst 208 B appears to be especially suited for lighter soils.

The phenomenon of the "falling off of yield," which has been noticed in the case of D 95, D 74, D 78 and and the White Transparent, and is now being shown by D 109, and which is paralleled in the experience of Java, is recognized by the Director as "very important and one which demands close attention."

Fertilizer Action.

A Valuable Paper.

Mr. A. D. Hall, of the famous Rothamsted Experiment Station, which for over half a century has been the scene—as it was the pioneer—of continuous agricultural experiments on an agricultural scale, contributes to the American Journal "Science," of Nov. 6th, an important and most informing paper on "Theories of Manure and Fertilizer Action" which was read by him as a lecture at the Graduate School of Agriculture, Cornell University, in July 1908. While summing up the present state of knowledge on this vital matter, the English expert finds occasion to criticize adversely the new and revolutionary theory, recently advanced by Messrs. Whitney and Cameron, that the beneficent action of fertilizers is really due to their destructive effect on the toxins or poisons excreted by the roots of plants in the soil (which it is alleged tend to accumulate to a harmful degree if the same crop is continuously grown on the same plot of land) and not to their modifying influence on the quantity and quality of the plant-food. The paper is too long for reproduction here and a brief summary only can be given; but this may serve to draw attention to a valuable contribution to the science of Agriculture.

Commencing, as is natural, with Liebig, Mr. Hall neatly re-states the German chemist's theory of the action of manures thus:—"The proper fertilizer for any particular crop must contain the amounts of nitrogen, phosphoric acid, potash, and other constituents which are withdrawn from the soil by a typical good yield of the plant in question," and proceeds to show from Rothamsted experiments on wheat, barley, and swede turnips that the theory is inadequate to explain the results observed. Thus wheat and barley though taking identical amounts of phosphoric acid from the soil are quite differently affected by phosphoric acid as a fertilizer; the effect on the former being of quite secondary importance, but in the latter comparing with that of the all-essential nitrogen. For both plants the addition of potash counts for little or nothing, although wheat withdraws 29 lbs. of that constituent from each acre of soil, and barley 36 lbs. Evidently the soil is able to supply all the requirements of the plant for potash in spite of the large amounts which the crop removes; and it is here, as Mr. Hall says, that Liebig's theory fails—it takes no account of the soil and the enormous accumulation of plant-food therein contained. "A still more note-worthy example

is provided by the swede turnip crop; the analysis of a representative yield would show it to withdraw from the soil about 150 lbs. per acre of nitrogen, 30 lbs. of phosphoric acid, and 120 lbs. of potash. Yet the ordinary fertilizer for the swede crop will consist in the main of phosphatic material with but a small quantity of nitrogen and rarely or never any potash. These differences in manurial requirements are, as the lecturer points out, correlated with the habits of growth of the plants The wheat possesses a very extensive root system and a long period of growth, hence it is specially well fitted to obtain whatever mineral constituents may be available in the soil; barley is a spring sown crop, but being shallow-rooted and having only a short growing season, the plant experiences a difficulty in satisfying its requirements for phosphoric acid; the swede is sown late in the season after a very thorough preparation of the soil, so that the nitrification alone of the nitrogenous residue in the soil is capable of furnishing almost all the large amount of nitrogen it requires, but it is very shallow-rooted and must be supplied with an abundance of phosphoric acid."

A Complex Subject.

Yet this explanation does not begin to exhaust the possibilities of what is an extremely complex subject "Many plants do not exhibit such idiosyncrasies as are shown by wheat and swedes, but require a general fertilizer the composition of which is determined more by the soil than the plant. Indeed, no theory of manuring can be based upon the plant alone, but must also take the soil into account, so that a fertilizer may be regarded as rectifying the deficiencies of the soil as far as regards the requirements of the crop in question. What those special requirements are can only be decided by experiment. Mr. Hall comes to the conclusion that the best general point of view of the action of fertilizer is, perhaps, obtained by extending the "law of the minimum" originally enunciated by Liebig, (according to which the yield of a given crop will be limited by the amount of the one particular soil constituent which may happen to be deficient) and extending it to "all the factors affecting the yield as well as to the supply of plant-food, *e.g.*, to such matters as the supply of water, the temperature, the texture of the soil. On poor soils the water supply is very often the limiting factor, on very open soils because the water actually drains away, on extra close soils because the root range is so restricted that the plant has but little water at hand and the movements of soil water to renew the supply are very slow;

in either case the plant will be sure to have as much nutriment as is required for the small growth permitted by the water present. It is only when the water supply is sufficient that the resources of the soil as regards all or any of the constituents of a fertilizer are tested, and may be become in their turn the limiting factors in the growth of the crop. Hence it follows that fertilizers may often be wasted on poor land where growth is limited by the texture of the soil, by the water supply or some other factor." Points are made by the lecturer of the huge amount of plant-food actually present " though in a highly insoluble condition," in soils—" The soil of the manured plot on the Rothamsted wheat field contained in 1893, after 54 year's cropping without fertilizer, 2 570 lbs. per acre of nitrogen, 2,950 lbs. of phosphoric acid, and 5,700 lbs. of potash "—and of "the law of diminishing returns" by which the first expenditure of fertilizer or other factor of improvement is the most effective, each succeeding application producing smaller and smaller returns, until a further addition causes no increase in the yield; and a remarkable proof is given of the direction of the movement of soluble salts in the soil. It appears that in the soil all reactions are extremely localized, since they take place in the thin film of water normally surrounding the soil particles, in which movement of the dissolved matter takes place very slowly and mainly by diffusion. At Rothamsted two grass plots, have received for 52 years in succession very large amounts of soluble fertilizer (in the one case 550 lbs. per acre of nitrate of soda and in the other 600 lbs. per acre of ammonia salts) and though these plots are separated only by an imaginary line from others receiving either no fertilizer or a characteristically different one, the distinction remains perfectly sharp "and the rank herbage produced by the excess of nitrogenous fertilizer on one side does not stray six inches over the boundary." A test of the soil to a depth of seven feet (in 1893) in the Rothamsted wheat field—in which the fertilized plots are separated from each other by infertilized strips only 12 inches in breadth—showed clearly that the amount of nitrates found " was in each case characteristic of the supply of nitrogen to the surface of the plot, and right down to the lowest depth there were no signs of the proportions approximating to a common level as they would have done had any considerable amount of lateral diffusion taken place." As the treatment has been continued in all cases for at least 40, and in some instances for 50 years, Mr. Hall seems justified in his conclusion that the evidence indicates that "the movements of the soluble salts in the soil are confined to up-and-down motions due to percolation and capillary uplift, and take place laterally only to an insignificant extent."

THE "POISON" THEORY.

Having come to these general conclusions, Mr. Hall proceeds to consider Messrs. Whitney and Cameron's theory of the action of fertilizers. This would appear to be inspired by a real difficulty—indeed, the Rothamsted expert admits it to be "fundamental"—which may be illustrated by the behaviour of phosphoric acid when applied as a manure. It is a fact that a soil may contain enormous quantities of plant-food and yet be by no means notably fertile—for instance 2,500 lbs. per acre of phosphoric acid may be present and yet swedes will not do well unless supplied with an additional dressing of 50 lbs. per acre of soluble phosphoric acid—and "it is usually assumed that the effect of this phosphoric acid manuring is due to the soluble nature of the fertilizer, because of which the additional plant-food is directly available for the crop." A study of the re-action in the soil, however, shows that this theory is insufficient; the soluble phosphoric acid is very rapidly precipitated in the soil and remains so close to the surface that it is never washed out in the drains. Upon such facts as these, Messrs. Whitney and Cameron argue that "the concentration of the soil water for a given plant-food, such as phosphoric acid, must be approximately constant for all soils of the same type, however much or little phosphatic fertilizer may have been applied, and since water culture experiments show that this low limit of concentration attained by the soil water is more than sufficient for the needs of the plant, no soil can be regarded as deficient in this or any other element of plant-food. It therefore follows that the action, if any, of a fertilizer must be due to some other cause than the direct supply of plant-food, with which the soil water must always be saturated to a degree which is quite unaffected by the supply of fertilizer;" and following up this conclusion they suggest this theory of fertilizer action:—"A soil falls off in fertility and ceases to yield normal crops, not because of any lack of plant-food brought about by the continuous withdrawal of the original stock from the soil but because of the assimilation of injurious substances excreted from the plant itself. These toxins are specific to each plant, but are gradually removed from the soil by processes of decay, so that if a proper rotation of crops is practised its yield will be maintained without the intervention of fertilizers. The function of fertilizers is to precipitate or put out of action these toxins rather than to feed the plant."

Mr. Hall's criticism of both theory and arguments cannot be considered as anything less than destructive. He declares that Messrs. Whitney and Cameron's views cannot have any bearing

whatever on the amount of nitrates in the soil water "since they come into a dissolved state as fast as the nitrifying bacteria produce them, and are not in equilibrium with any store of undissolved nitrates in the background. As regards phosphoric acid the theory assumes such an excess of bases that all soils behave alike and immediately precipitate the phosphoric acid in practically the same form; while as regards potash the argument seems to forget that though the addition of a soluble potassium salt may throw some of the other sparingly soluble potassium compounds out of solution, the total amount of potassium remaining in solution is still greatly increased. The function of the carbonic acid in the soil water is ignored, as again the fact that the processes of solution in the soil must be in a constant state of change." The crucial test by analysis of the soil water fails, so far as Rothamsted is concerned, for "when the Rothamsted soils, with their long-continued difference in fertilizer treatment, are extracted with water charged with carbon dioxide, the nearest laboratory equivalent to the actual soil water, the amount of phosphoric acid going into solution is closely proportional to the previous fertilizer supply." The new theory also supposes that the plant itself exerts no solvent action; but besides Sachs' famous "etching" experiment, an ingenious device by Kossowitsch seems to prove conclusively that roots have a preponderating influence on the assimilation of phosphoric acid at any rate. "The only factor determining the supply of phosphoric acid and the consequent difference in growth," says Mr. Hall in quoting this experiment, "was the solvent action of the roots where they were actually in contact with the calcium phosphate, and this solvent action.... may most probably be attributed to the carbon dioxide secreted by the roots."

NOT PROVEN.

With regard to the "toxin" part of the theory, Mr. Hall has some pertinent comments to make. He doubts whether the alleged toxins extracted from the soil by Whitney are really excreted by the roots of the plants and whether they are really toxic in the soil merely because they have been proved so in water cultures. "A body like ammonia, itself a product of protein decay and present in the soil, is exceedingly toxic to water cultures, yet when applied to the soil it increases the growth of the plant." Particularly is it the specific action of fertilizers that is so difficult to explain on this hypothesis. "Why," he asks, "should substances so dissimilar as nitrate of soda and sulphate of ammonia exert the same sort of action on the same toxin? Why should phosphates cause all classes of plants to develop in

one direction, or why should it be appropriate to the toxins of all plants on one particular type of soil, whereas potash answers on another type? Lastly, there is a lack of evidence for the fundamental thesis that the rotation will take the place of fertilizers and that the yield only falls off when a particular crop is grown continuously on the same land." This last he proves from the Rothamsted experiments which have shown "that wheat can be grown continuously upon the same land for more than fifty years and that the yield when proper fertilizers are applied remains as large in the later as in the earlier years of the series.... Mangolds....show no falling off in yield though they have now been grown upon the same land for thirty-two years."

Nevertheless the "sickness" of land continuously under one crop is a fact which the Rothamsted experiments undoubtedly confirm, and Mr. Hall is prompt to admit it. There is some positive evidence that "most plants—some to a very slight degree, like wheat and mangolds, others markedly, like clover, turnips and flax—effect some change in the soil which unfits it for the renewed growth of the crop," and this injurious factor may be, Mr. Hall thinks, "either the excreted toxins of Whitney's theory or may be some secondary effects due to the competition of injurious products of the bacteria and other microflora accumulating in the particular soil layer in which the roots of the crop chiefly reside." But "as it stands at present Whitney's theory must be regarded as lacking the necessary experimental foundation, no convincing evidence has been produced of the fundamental fact of the excretion of toxic substances from plants beyond the autotrophic seedling stage, nor is there direct proof of the initial supposition that all soils give rise to soil solutions sufficiently rich in the elements of plant food to nourish a full crop did not some other factor come into play."

"If, however, we give the theory a wider form, and, instead of excretions from the plant, understand débris of any kind left behind by the plant and the results of bacterial action upon it, we may thereby obtain a clue to certain phenomena at present imperfectly understood. The value of a rotation of crops is undoubted and in the main is explicable by the opportunity it affords of cleaning the ground, the freedom from any accumulation of weeds, insect or fungoid pests associated with a particular crop, and to the successive tillage of different layers of the soil, but for many crops there remains a certain beneficial effect from a rotation beyond the factors enumerated." That the clue lies in "disinfection" of some kind would seem to be indicated by Mr. Hall; who in his closing remarks draws attention to the increase of fertility which follows partial sterilization of the soil

either by heating or by the use of volatile antiseptics such as toluene or carbon bisulphide. But he concludes with a warning which may well be taken as a "word to the wise": "The soil," he says finally, "is such a complex medium—the seat of so many and diverse interactions, chemical, physical and biological—and is so unsusceptible of synthetic reproduction from known materials, that experimental work of a crucial character becomes extremely difficult, and above all requires to be interpreted with extreme caution and conservatism."

Cultivation and Utilization of Annatto.

(*From the Bulletin of the Imperial Institute, Vol. vi., No. 2, 1908.*)

In connection with the question of annatto production in the colonies, especially in West Africa and Ceylon, the following memorandum has been prepared and is now published for general information.

Annatto is the orange-red colouring matter occurring as a layer of pulp on the outside of the seeds of the annatto plant, *Bixa orellana*, a small tree indigenous to South America but now extensively cultivated in many tropical countries.

The supplies of annatto which reach the United Kingdom at present come principally in the form of the seeds from the East and West Indies, and as paste from French Guiana or Brazil.

CULTIVATION OF THE PLANT.

The annatto plant grows luxuriantly in almost any soil, and in the tropics will thrive up to about 3,000 feet above sea level. The soil is prepared for annatto in much the same way as for cotton. The seeds, previously softened by soaking in water, are planted in furrows at distances of 8 to 10 feet apart. As the young plants come up they should be provided with artificial shade to protect them from excessive heat, but later on a large amount of sunshine is necessary for their proper development. After three months the plantation should be weeded and superfluous plants removed. Beyond periodical weeding the plantation requires little attention.

HARVESTING.

Full crops of seeds may be obtained in three or four years from the time of sowing, but the collection of seed may be commenced usually after the first eighteen months or even earlier. The fruit capsules are gathered when they have acquired a reddish colour and are just beginning to break open. This takes place from the pointed end along the edges and causes the seeds to be exposed. It is said to be advantageous to cut the branches along with the capsules, as in this way the plants are prevented from growing so high as to make collection a matter of difficulty, and they bear better.

The capsules are opened out on mats or cloths and allowed to dry completely in the sun, being turned over from time to time. Three or four days' exposure is usually sufficient to accomplish

this, and the fruits are then collected into heaps and beaten with clubs or thrashed to separate the seeds. These are separated from the empty pods by winnowing or sifting, and again exposed to the sun until they are completely dry.

The seed is usually packed in barrels for export but manufacturers using annatto in the United Kingdom recommend that they should be packed in double sacks holding from 1½ to 2 cwt. each. Great care should be taken to see that the seeds are dry before they are packed, as if they are at all damp they are liable to become mouldy and lose colour.

Commercial Value of Annatto Seeds.

The prices obtained for annatto seed in London in the last few years have varied somewhat. Ceylon and Madras seed fetched from 6d. to 7d. per lb. at the end of 1905 but gradually fell to 3½d. or 4d. during 1906. Jamaica seed similarly fell from 8d. at the end of 1905 to 4d. in October, 1906. At present 4d. per lb. may be taken as the average value. Java seed, which goes principally to Liverpool, is at present worth 4d. to 5d. per lb. The most recent quotations available are 4d. per lb. for Madras seed and 3½d. per lb. for Ceylon seeds.

There is a fair demand for annatto seed in the United Kingdom, and the annual imports are said to fluctuate between 75 and 100 tons, and manufacturers of annatto preparations are of opinion that the demand is likely to grow. There is said also to be an increasing market in the United States for annatto, but this is likely to be met by a large output from Jamaica. It should be borne in mind, however, that the annatto plant can be grown practically anywhere in the tropics, that plantations have been formed in many tropical countries, and that if prices rose there would probably be an immediate increase in output from plantations already in existence.

Preparation of Annatto Paste.

At one time considerable quantities of annatto paste were imported into the United Kingdom and other European countries from French Guiana and Brazil, but although textbooks dealing with annatto dye still refer to the paste as the principal form in which annatto is imported there is reason to believe that this trade has almost ceased. Thus, no export figures for annatto paste from French Guiana have been given in the statistical returns for the French Colonies since 1900. Annatto paste was imported into the United Kingdom from Ceylon in considerable

quantities some years ago, but owing, it is said, to a falling off in the quality of the material the demand for it diminished.

Manufacturers in the United Kingdom, and merchants handling annatto paste, say that the reason for the decline in the market for this article is entirely due to the practice of adulterating it in the countries where it is grown ; and that if a clean paste of good quality were produced it would command a ready sale. Unless, however, a paste of excellent quality can be made it is better to export the seeds.

In Brazil annatto paste was formerly made by crushing the seeds in hot water, decanting the liquid containing the colouring matter in suspension, and evaporating it to a pasty consistence in shallow pans over a fire. More recently, however, in Brazil and French Guiana the uncrushed seeds have been mixed with hot water and the mass agitated until the whole of the pulp carrying the colouring matter has been washed off. The muddy liquor so produced is decanted through a sieve to remove the seeds. The liquor is then allowed to stand until the insoluble colouring matter held in suspension settles to the bottom when the useless supernatant liquid is poured off and the wet paste or colouring matter is dried by exposure to sun heat. The paste so produced can be prepared for the market in several ways. It may be formed into rolls weighing from 4 to 5 lb. each, and after drying wrapped in banana leaves and then packed in boxes or sacks, as is the custom in Brazil ; or it may be made into small cheese-like masses weighing from 1 to 2 oz., and these, when quite dry, packed in boxes holding from 4 to 5 cwts. The French Guiana variety of annatto is superior in quality to the Brazilian (Spanish).

It will be seen that no special machinery is required for the production of annatto paste by these processes, but doubtless the extraction of the colouring matter could be done more efficiently and rapidly if mechanical agitation were employed to keep the seeds in motion while they are in the water, and similarly the separation of the colouring matter from the mother liquor and its subsequent drying could be more cleanly and rapidly effected by the use of a filter press.

Owing to the very small demand existing for annatto paste in the United Kingdom at the present time it is impossible to obtain a satisfactory idea of its commercial value, but it appears that Cayenne paste from French Guiana fetches about 10d. per lb. in France at present, and that good qualities of Ceylon paste when imported into the United Kingdom were worth, as a rule, from 1/6d. to 2/- per lb.

Uses of Annatto

At present annatto is principally employed as a colouring agent for food materials such as butter, magarine and cheese. It was formerly used in considerable quantity for dying silk, but is now little employed for this purpose, as better dyes less fugitive to light are available.

"Witch Broom" Disease of Cacao.

INVESTIGATIONS IN SURINAM.

An interesting and important monograph* on the origin, nature and treatment of the "witch broom" disease of Cacao as it occurs in Surinam has just been published by Dr. C. J. J. van Hall and A. W. Drost. At the outset the Dutch investigators traverse Ritzema Bos' statement that the disease is due to *Exoacus theobromae.* Bos, they say, discovered no mycelium in the "witch brooms" and described no fungus, nor did Massee—who studied cacao specimens (preserved in alcohol) sent from Surinam by Hart, the Trinidad specialist—and Howard confirm Bos' observation. Went,† they maintain, was the first to submit the diseased organs of the plant to a thorough examination, and he discovered a mycelium in the "witch brooms" and therewith the cause of the disease; he gave a detailed description of the path of the mycelium in the tissues of the host, recounted the principal symptoms of the disease, and expressed the opinion that the hardening of the pods was due very probably to the same fungus as caused the "witch brooms."

Proceeding to a careful account of the appearance and progress of the disease in Surinam, the authors remark that it is impossible to discover a "wind influence" in the spread of the disease, and that on plantations where only a few trees have been attacked the contagion is propagated but slowly. Yet the damage done in Surinam was sufficiently serious. The number of bales (of 100 kg. of cacao) exported dropped from 38,600 in 1899 to 8,540 in 1904, but rose again to 1,806 in 1906; and, generally, the authors conclude that the figures show a gradual increase of the disease to a climax (paroxysme) in 1904 and then a certain recession. This applies not only to the total production of the whole colony but also to that of the several plantations. The gradual increase is easily explicable by the gradual multiplication of the parasite, but the decrease is not so simply accounted for; though many examples could be cited of a similar course—growth, climax, fall—in other plant diseases. The point is, will the recorded decrease continue until the disease spontaneously disappears, or will it diminish and eventually stop altogether, and increase recommence; the disease thus oscillating about an "average of virulence?" The authors, though with regret, can find no

* "Les balais de sorcière du cacaoyer provoqués par *Colletotrichum luxificum* n. sp. par le Dr. C. J. J. van Hall et A. W. Drost. (Extrait du Recueil des Travaux botaniques Néerlandais. Vol. IV., 1907.)

† Krulloten en versteende vruchten van de Cacao in Suriname. (Verb. Kon. Akad. v. Wetensch., 2e sect. X. 3. 1904.)

satisfactory evidence to support the optimism of the Dutch planters who adopt the former view. Nay, they are convinced that the disease will never disappear unless serious steps are taken to attack it.

Symptoms of the Disease.

Follows a useful account of the normal development of the leafy branches and flowers of the cacao, and then a recapitulation of the external symptoms of the disease. It may be remarked here that the illustrations (in phototype) are excellent and to the point. These symptoms are summed up under three heads :—

1. The "krulloten" or "witch-brooms"; which are hypertrophied branches, thickened, especially at the base, and with a surface roughened by longitudinal corrugations. They are further distinguished by their leaves (of which the stipules persist in a remarkable manner) remaining small and stunted, soft and supple, like the half-opened leaves of the normal branches, and often taking on an unusually dark colour ; by the tendency of their axillary buds to give rise to lateral branches before the "krulloot" has attained its full length ; by their more or less vertical method of growth ; and by their extremely short life (vie éphémère)—death commencing at the base of the branch. These dead "brooms" constitute a menace to the life of the tree, for they afford easy points of attack for parasites, especially for *Chaetodiplodia.*

2. The hardening (induration) of the pods ; a symptom which was not recognized as characteristic until a considerable time after the "krulloten" were admitted to be typical, and was at first identified or confounded with the "blackening of the pods" which is usually attributed to infection by *Phytophthora omnivora* —though the Dutch savants question whether this fungus is the cause of the "blackening" of cacao in Surinam. The "induration" shows itself under three types: in the first the peduncle is hypertrophied, in the second the fruit displays one or two "gibbosities" or swellings but usually no hypertrophy of the peduncle, in the third the pods exhibit one or two (rarely more) black spots. It is this last form of the disease which has led to the confusion between "hardening" and "blackening." In both cases black spots occur ; but in the former the peripheral tissues of the pod are hard, while in the latter they remain soft and brittle. It would appear that in the third type the pods are not so badly infected by the disease as in the other two : for while those with swollen peduncles or with gibbosities always die rapidly and never yield any beans which can be

used, the spotted fruits are not necessarily spoiled. Such seeds as they produce are, however, of light weight and sometimes exhibit a curious tendency to germinate while still in the pod—a phenomenon which is unknown among the normal and healthy beans. If planted out, they give rise to sorry specimens: which is not surprising.

3. The presence of "star-flowers" ("sterbloesems," "fleurs en étoile.") Dr. van Hall and his colleague claim that they were the first to point out these as the symptoms of the disease. The "star-flowers" are borne on fruit-branches which present the same pathological symptoms as the "witch-brooms"—an hypertrophied growth accompanied by an exaggerated development of the lateral ramifications,—and they appear as an agglomeration of a large number of flowers inserted in the peduncles, and having among them vegetative branches transformed into little "krulloten." They seldom give rise to ripe pods; the fruit of them is usually malformed and globular and devoid of beans—the "man-cacao" (cacao mâle) of the Dutch planters—and sometimes vigorous "witch-brooms" bearing flowers spring from them.

Cause of the Disease.

The cause of the disease is, according to the Dutch authorities, the fungus discovered by Went, which is found in the form of an "intercellular mycelium" in the "krulloten," the "star-flowers," and the diseased portion of the indurated pods. This mycelium is constantly present and can be cultivated by the usual methods, apart from the host plant. The description of its characters and life-history is too technical for reproduction here, but those interested would do well to refer to the original monograph, which will repay perusal. The parasite has been carefully studied by Dr. van Hall and Herr Drost—who speak of it as "our fungus"—and the name *Colletotrichum luxificum* given to it. Its specific appellation was suggested by Professors Went and Damsté (Latin *luxus*, luxuriant; Greek *loxos*, twisted) and seems to indicate very happily the property the fungus possesses of stimulating its host to hypertrophic growth and the development of the curious "krulloten." The exact method in which the parasite infects the cacao appears still to be determined, and must await precise inoculation experiments; but it would seem that infection is possible only at an extremely early stage in the development of the various susceptible organs. The spores of the fungus may often be seen in the form of strings of beads (chaplets) on the surface of diseased pods and the bases of infected branches, especially

at the commencement of the "long dry" season or during periods of drought.

The ill-effects of the disease are seen chiefly in the reduced crop. It does not appear that the fungus in question is necessarily fatal to the adult cacao trees, though it is disastrous in the nursery; it is the secondary effects that are to be feared. Thus the "witch-brooms" that die off frequently leave cankerous wounds in the bark, and these give the *Chaetodiplodia* its opportunity. The profound enfeebling which follows the repeated fall of the leaves due to *Thrips* may also complicate a case of infection by *Colletotrichum* and lead to fatal results.

With regard to the immunity or susceptibility of individual cacao trees to infection, the experiments, so far, do not show that any particular strain enjoys the one or displays the other to any marked degree. Nor do our authors think that selection affords much assistance in this direction. Further, they could trace no connection between the disease and the influence of sunlight, drainage, or the composition of the soil. All these things had apparently no effect on the rise and fall of the figures which represent the incidence of the disease. The conclusions eventually arrived at are at least remarkable. It is admitted that Pln. Margarethenburg, where no shade trees are employed in the cacao cultivation, has long been spared by the "witch-broom;" but the presence of the disease has been demonstrated on that estate now, and, say the writers, "the future will teach us if the disease will do as much damage there as on the plantations where the cacao is shaded." Opinions among the Surinam planters seem to be divided; one party holding that the disease is favoured by poor drainage, the other that the cacao is too much shaded and that the pruning and thinning out of the shade trees is the course to pursue. These latter "rely on the opinion, which has become an axiom, though absolutely erroneous, that sunlight is unfavourable to moulds (fungi.)" As already stated, the Dutch authorities deny that the density of the shade has any action whatever on the disease. The "witch-broom" has flourished on all the cacao estates in Surinam, without exception, in which it has gained a footing.

Experiments with various manures and different soils gave negative results. One thing, and one thing only, appeared to influence the disease, and that was "the climate, and consequently the seasons." The effect of meterological conditions is marked; and as a rule, one may say that abundant rains, and the dampness of air they bring with them, favour the appearance of "witch-brooms." This point is elaborated in

detail by the authors, and illustrated graphically; and their results are summed uo thus:—

"We have shown that as a general rule abundant rains and a humid atmosphere favour the fructification of *Colletotrichum*. It is not necessary to conclude, however, that a very rainy year will produce an increased number of hardened fruits. It is not so much the absolute quantity of rain as the manner in which it is distributed during the year, that is decisive; a moderate, regular rainfall, recurring each day, is more favourable (to the disease) than a few very violent downpours alternating with dry and sunny days. Thus the year 1907, for example, with its abnormally abundant rains in April, has not proved so harmful to the cacao as the less rainy year 1906."

The question whether the *Colletotrichum* lives as a parasite on other plants beside the cacao is dismissed in a short chapter of the monograph. Although abnormal growths similar—sometimes remarkably like—the "witch-brooms" are found on the Bois immortelle (*Erythrina glauca*), on the mango, the sapodilla, and species of *Eugenia* (*chrysophylloides*), in no case do our authors find that their *Colletotrichum* is the cause of the diseased condition.

TREATMENT OF THE DISEASE.

Professor Went pointed out that two methods of treatment offered themselves for consideration—either the "force of resistance" of the trees themselves might be augmented, or the organism that caused the disease might be directly attacked.

As regards the force of resistance of the cacao trees Dr. van Hall and his colleague have shown that this is very slightly influenced by external conditions; it appears that neither the composition of the soil nor the level of the water-table (le niveau des eaux souterraines) nor sunlight exercises any action whatever on this force of resistance. Experiments undertaken to diminish, by copious manurings of phosphate, lime or humus, the susceptibility of the cacao, have given only unfavourable results. Selection, even if possible, requires time; a practical remedy is urgently required in view of the present activity of the disease; and the writers of the publication under notice "plump" for attacking the parasite direct.

Two methods are suggested: first, the destruction of infected parts, to prevent re-infection, and, secondly, the treatment of the trees with fungicide.

In applying the second method practically, the Dutch investigators encountered difficulties at the outset. Employing Bordeaux mixture on two estates in the month of December, 1903, they found that operations had to be suspended owing to the persistent rains of the following January and February. Recommencing in November, 1904, and spraying the trees methodically once a month, they yet found it impossible so to spray the cacao that every portion of the plant should receive its share of the fungicide. This was due to the thickness of the foliage of the cacao and to the fact that in the tropics trees do not put out their leaves, and branch, at fixed times, nor carry bare boughs for stated periods of the year. On the contrary, they sprout continually; and thus, in these trials, new leaves and new branches arose during the intervals of the sprayings.

The way in which the difficulty was got over was drastic enough, but in the upshot, satisfactory. The whole leafy crown of the cacao trees was removed, all the leafy shoots were cut away, and nothing was allowed to remain standing but the trunk and the larger branches. The trees were pollarded, in short; and the phototype illustrations of the method as put into practice show that the "cure" was indeed a radical one. All the resulting rubbish was, of course, piled in a heap and burned. The tree was sprayed with Bordeaux mixture.

Two salient questions at once arose: would the trees bear, without injury, this drastic pruning (cet élagage à fond), and were the centres of infection (foyers de contamination) definitely destroyed? Both queries were answered in the affirmative as the experimenters proceeded.

The pollarding was carried out on certain trees on Pln. Suzannadaal, on November, 1906. Towards mid-December they had commenced to put out buds; and when they were photographed in July, 1907, they had already reformed a vigorous "crown." Some six-year-old plants on the same estate were pruned as drastically as those already mentioned, in January, 1907. In less than six months they had, to all appearance, (judging from the published photograph) recovered. One point, however, is insisted on: the pruning must be done in the "long dry" season (September to November), during which the cacao trees are "resting." Besides, the absence of rain gives the fungicide a fair chance of remaining long enough in contact with the spores to destroy them.

The result of this treatment has been proved to be the practical extermination of the fungus. A few "krulloten" appear after the pruning and even some indurated fruits; but their num-

ber is trifling. In any case a minute "cleaning up" (nettoyage) is required to follow the pollarding, and it is stated that a careful workman should, at small cost, be able to cut off and destroy the signs of the disease to the last "krulloot." After the cleaning up, the trouble may be said to have been stopped; but supervision should be continued so that any fresh symptom may be recognized and eradicated at once. And in lopping the "witch-brooms" care must be taken to excise any infected part of the mother-branch; for, as mentioned above, a certain cankering often obtains at the base of a "krulloot"—the favourite seat of the fungus.

One more question, and that a most important one, remains to answer: how long a time must elapse before the trees thus pollarded will again give an appreciable crop?

The first year after the treatment the trees will give some, but of course only a few, pods. All the energy of the plant is spent in forming new leaves and shoots. The first year must, then, be put down as a dead loss; the second season's crop will possibly rise to ½ to 1 "balle per akker"; sufficient time has not yet elapsed to give an estimate for the third year, but by the end of 1908 the results of the treatment of three plots—treated in 1905—will become available.

A last word on the cost of the method. On Pln. Suzannadaal the price worked out at 10 fl. per "akker" for manual labour and *2 fl. for the copper sulphate; a total of 12 fl. per "akker," or 28 fl. per hectare. The loss of a year's crop was involved; but this, the authors say, is difficult to estimate in money. The total cost of a course of treatment lasting 15 months may be put down at about 52 fl. per "akker" or 117 fl. per hectare.

* 1 fl. = 40c. B. G. currency.

Utilizing the Colony Fruit.

In the Journal of the Board of Agriculture, Vol. I, No. 4, April, 1908, an article entitled "The Possibility of a Local Fruit Industry" appeared, in which was pointed out the great waste which goes on year by year amongst the fruits both indigenous and introduced growing in the colony.

It has been suggested that this be followed up with instructions as to the preparation and making of jams and jellies from these local fruits.

To emphasize the need of such instructions I quote extracts from the Journal of the Royal Horticultural Society, June, 1908, Vol. XXXIII, Part II, on the Exhibition of Colonial Grown Fruits, Vegetables and Preserves, held on November, 28 and 29, 1907:—

> "Nor should the Colonial Preserves—jellies, syrups, and "bottled fruits—pass entirely unmentioned; for though "at present they cannot truthfully be said to compare "favourably with the home produce, yet at the same "time they evidence what the Colonies can do, and "hold out the promise of a far better production in "the near future."

"Report on a small parcel of Jams from St. Helena."—

> "It would not be kind to speak of these jams in such a way "as to encourage the islanders to embark on their "manufacture on a large scale, only to meet with "subsequent disappointment. True kindness consists "in pointing out faults and suggesting how they may "be corrected in future, and a really saleable article "produced."............" I am sure the islanders can "manufacture a good saleable article if they will make "certain absolutely necessary alterations in their "methods:—
>
> "*Bottles.*—These are of a very awkward pattern, making "it difficult to get the jam out. One-pound or two-"pound pots, or wide-mouthed bottles, or seven-pound "jars must be adopted."
>
> "*Bungs.*—The ones at present used, of soft pappy "wood, are most unsatisfactory. A corkscrew refuses "to pull them out, but comes away through them. If "the use of the bottles is continued a glass stopper or "a cork bung is essential.

> "*Texture and quality.*—Referring to the jams generally, "they are more of the nature of confections than jams. "They are all, without exception, much too sweet and "much too sticky. They have probably been cooked "far more than is necessary, dispersing the liquid "juices of the fruit and leaving far too much sugar, "which at once begins with crystalize and candy. "Less sugar must be used, and they must be less "cooked."

Now this report on the St. Helena jams may be taken, with a phrase excepted here and there, as a truthful statement of the condition of the preserves usually shown in competition at our Exhibitions; a fact which has been repeatedly pointed out in the reports. In bottles there has been a great improvement, and the tall "sweetie" bottles are now almost a thing of the past; the one-pound screw-top being used instead. As to corks—where used—these are still unsatisfactory. Any old cork which has done duty over and over again is used, and these not always well sealed. As to texture and quality, the report is as true of most of our preserves as of those of St. Helena.

For the following instructions I am indebted to my wife, who, during over 35 years' residence in the tropics, has cooked and tried everything which can be used as table vegetables, and has preserved in many ways all edible fruits.

Fruit for preserving should be quite full but not over ripe. The reason why so much guava jelly ferments if kept long is because damaged or over-ripe fruit is used.

The rejected fruit need not be wasted. It can be made into jam or jelly for immediate use.

The guava takes first rank among tropical fruits. The most suitable preserving pan is an enamelled one. For stewing, the fruit should be carefully peeled, cut into halves or quarters with a sharp knife, the seeds extracted with an enamelled or silver spoon. The seeds and peels may be soaked or boiled in water, and the strained water used for cooking the fruit. To every 2 lbs. of peeled and cleaned fruit allow one pint of water, boil slowly till tender, taking care in stirring not to crush the fruit. When soft, add 1½ lbs. of best granulated sugar, and boil quickly for 15 to 20 minutes. If this be put into wide-mouthed screw-topped bottles and covered immediately, it will keep good for a long time.

For *Guava Jelly* the fruit must be cut, and boiled in sufficient

water to well cover it from 20 to 30 minutes, stirred with a wooden or enamelled spoon to loosen the seeds and prevent burning; then carefully strained through a coarse cloth or muslin; left a little while to settle, and then the clear water used in the proportion of 2½ pints to 2 lbs. of sugar.

Let the water boil, then add the sugar and a piece of alum about the size of a small cherry. From the time it starts boiling again it must boil as fast as possible for 20 minutes:—the pan must be large, so that its contents will not require constant stirring, to prevent boiling over, as every time a cold spoon is put in it receives a check and so requires longer cooking. To make clear, bright jelly very fast boiling is essential. Have ready a piece of cellular cloth or coarse muslin, strain the jelly immediately, put into bottles, fill full, and screw down at once.

Pine-apple Jam.—This requires great care, as it burns very easily. The fruit must be chipped or grated, weighed, or measured, boiled in its own juice or, when necessary, a little water may be added. Then to every pound or pint allow one pound of granulated sugar and boil quickly, stirring constantly for 30 minutes or even a little longer if it is to be kept long or exported.

Carambola Jam—The fruit must be prepared by cutting off the acute edges, then cutting into pieces about ¾ inch thick; boil 2½ lbs. in 1½ pints of water till tender; which will take about 15 minutes; then add 2 lbs. of best granulated sugar and boil for 15 to 20 minutes. The seeds give a delicious noyeau flavour.

The same quantities of fruit, water, and sugar, and the same time for boiling does for *Sorrel Jam*; this is improved by the addition of a few cloves.

Sorrel Jelly.—For this the fruit must be boiled to a pulp, strained, and 2 lbs. of sugar and a few cloves added to every 2½ pints of juice. As in guava jelly, it must be strained when finished and corked or screwed down immediately.

Orange Marmalade.—For making this in the tropics, where the fruit is fresh and the rind full of the essential oil, very few of the recipes given in cookery books answer.

The fruit should be cut in quarters, the flesh separated and soaked in sufficient water to cover it, the peel in *salt* and water. The peel must be boiled in two or three waters; the first with salt to extract the bitterness. As soon as this water boils it must be poured off. If the peel be boiled more than a minute

or two with the salt no after boiling will make it tender. In the last water it must boil till soft enough to rub between finger and thumb. Then cut into thin slices, scraping away the white flesh.

Next, well rub the figs of flesh to get all possible juice and gelatinous matter out, and strain ; boil 2½ pints of this juice with 2½ lbs. of sugar. When nearly done—in 15 to 20 minutes —add 1½ lbs. of sliced peel, boiled together very slowly for 5 or 6 minutes ;—if boiled longer the peel will harden. Orange marmalade if properly made, bottled and covered while hot, improves by keeping.

A delicious preserve may be made of green mangoes by treating the fruit like pine-apple, *i.e.* grating or slicing them boiling till tender and adding sugar in the same proportion. Some mangoes are less acid than others ; to these it is necessary to add a little lime or lemon juice, and any spice preferred may be used, though ginger seems to give the best flavour.

Mammee Apples, Golden Apples, and Malacca Apples make good confections.

Cherries, Gooseberries, Hog Plums, and Governor Plums are best used for jellies. The directions given for guava jelly apply to these also.

The stickiness so often found in local jellies is due to long slow boiling, too much stirring, (thus chilling them), and the desire to make a large quantity regardless of quality.

JNO. F. WABY.

Formaldehyde as a Preservative of Cane Juice

In Hawaii, as in the West Indies, it is the general custom on sugar plantations to add lime to any juice which it may be necessary to keep over for a day or two when cane crushing is temporarily stopped, with the object of preventing fermentation. There are, however, disadvantages connected with the use of lime for this purpose. In the first place lime does not altogether prevent fermentation, not being a very efficient sterilizing agent. Further, the lime combines with the glucose present, forming dark coloured products, which investigation shows are responsible for the "sweating" and consequent deterioration of raw sugar. Another disadvantage of this course is that the greater part of the excess of lime added is deposited on the evaporator tubes or vacuum pan coils as soon as evaporation begins. In view of the above objections, the use of formaldehyde as a preservative agent of cane juice has been tested in Hawaii, apparently with satisfactory results. It has been in use for this purpose for a number of years with laboratory samples of juice.

The juice experimented with was first clarified by adding milk of lime untll just alkaline to litmus, heating to boiling and then filtering. In the experiment a very small quantity of formaldehyde (0·025 c.c. per litre of juice or 1 part to 40.000 parts of juice) sufficed to keep the juice from fermenting for twenty-four hours. A considerably increased proportion, i.e., 1 part of formaldehyde solution to 3,500 parts of juice was necessary, however, to prevent fermentation on the second day. When added in this quantity, the proportion of saccharose was still the same at the end of the third day, showing that no fermentation had taken place. When the formaldehyde solution was added at the rate of 1 part to 2,500 parts of juice, it prevented fermentation for four days. When fermentation has once started, it is very difficult to stop it, and under those conditions the experiments showed that 1 part of formalin to 1,600 parts of juice checked the fermentation, after it had been in progress for a short time, for only twenty-four hours.

In ordinary mill work, the amount of formaldehyde required for preservation purposes would probably be somewhat larger than the quantity used in the above experiments, depending on the extent to which the juice was exposed to fermentation organisms. At the Hawaiian and Commercial Sugar Company's factory, where formaldehyde is generally employed, 1 c.c. is

added per gallon of juice, which prevents fermentation for from twelve to sixteen hours.

In any mill using formaldehyde for the first time, it would be advisable to have the juice polarized frequently, in order that loss of saccharose might be observed and the progress of fermentation estimated. In this way the minimum amount required for purposes of preservation might be determined.

In the above experiments a 40 per cent. solution of formaldehyde in water (ordinary formalin) was employed.—*West India Agricultural News.*

Care of Horses' Feet.

Broken and diseased hoofs result from ignorant shoeing. When the foot is gone, there is no horse left. There is an old adage to this effect, the truth of which is incontrovertible. Yet no part of a horse's anatomy is worse used than the feet, and there are no more frequent diseases brought to the notice of the veterinary surgeon than those of the feet. This comes of the unwise fashion of rasping, cutting, burning, tarring and greasing the hoofs.

Horn is a fibrous substance which contains 25 per cent. of water. When horn is deprived of water it becomes dry, hard and without elasticity, precisely like a piece of dry glue which breaks and splinters into glassy fragments. The common practices of burning the sole to procure a fit for the shoe, or rasping the outer surface to get a good shape, and of tarring and greasing the hoof, all tend to drive the water out of the horn, and not only to harden and contract it, but to make it brittle.

The substance of the frog is horn, but it is of a softer and more open texture than the sole and crust of the hoof. It is therefore the more easily affected by injurious conditions, and when it is deprived of its water it shrinks to a greater extent than the more solid horn.

From this explanation of the character of the horny covering of the feet any reasonable horse-owner may learn how to treat the hoofs.

When a shoe is to be fitted, the edge or wall of the sole should prepared by cutting or rasping, not by burning ; indeed, the shoe should be fitted to the foot, not the foot to the shoe. When from bad management, the sole and frog have become dry and contracted, no grease or tar should be used ; but water should be used freely, and then the hoof should be dressed with glycerine, which will mix with water and does not displace it.

Glycerine contains no acid or acrid properties, but is soft, bland, emollient, and does not evaporate. It therefore softens the horn, and allows the fibres to expand. Contraction is thus prevented or is overcome when it has actually occurred.—*North-western Farmer.*

Cuttings.

"There is always something to be learnt at the State farms at all times of the year."—*Queensland Agricultural Journal.*

"The value of little Hawaii's commerce was 14 per cent. of the entire foreign commerce carried under the American flag for the year 1907."—*The Hawaiian Planters' Journal.*

"The value of lime as a fungicide is gradually becoming more fully recognized, and it has been asked whether the good results that accrue from applications of lime in many sugar-producing countries are really due to the indirect manurial effects and clay-flocculating actions (as is generally supposed) or whether they are not rather due to the action of the lime on the living enemies of the cane."—*F. A. Stockdale, in Proc. Agric. Soc., Trinidad.*

"In this matter, as well as in so many others of attacking disease,............as I am constantly telling you, co-operation is needed, and badly needed, in Grenada. What is a slow and difficult task for one individual becomes a comparatively easy one for the general community."—*The Agric. Supt. of Grenada.*

"There are certain features by which the common edible mushroom may be with certainty distinguished from other gill-bearing fungi. A character which is readily seen is the colour of the gills. These when fairly young are a bright flesh colour gradually changing to a dark brown with a tinge of purple as the mushroom grows older, and eventually becoming almost black. True mushrooms never have white gills except when quite in the "button" stage, when it is safer to leave them alone unless clearly growing from the same clump as older specimens ....Lastly, remember that the common mushroom usually grows on open ground and never on trees or fallen stumps"—*Messrs. Phillips and Saxton; in the Agric. Journal of the Cape of Good Hope.*

"It is a well-established fact that an animal having but the smallest tubercular lesion gives the most characteristic reactions to tuberculin."—*W. Robertson, M R.C.V.S., Director of the Vet Lab, Grahamstown, S.A.*

"The liver (photographed) of the dog was from an animal, the constant companion of a consumptive girl, and in this case the fowls in the yard were found to be affected with the disease."—*Ibid.*

"Fruit production is destined to become one of Hawaii's most important industries. Already pine-apple growing has

assumed very considerable proportions.........where a few years ago the land was thought unfit for any other purpose other than grazing."

"To ascertain the best method of marketing, including every step in the process from the gathering of the fruit in the field, to its sale in the market, is quite as important in any fruit industry as the knowledge of production."—*Hawaii Agric. Exper. Station ; Press Bulletin 21.*

"Under existing conditions (in Southern Nigeria) it pays to export any timber that realizes 3d. and upwards per superficial foot in the home markets."—*(Official) Report on the Forest Administration of Southern Nigeria for 1906.*

"In the meantime our Minister got a Bill through the House giving power to compel orchardists to clean up their orchard and destroy, by burning or boiling, all infected fruit."—*Mr. W. W. Froggatt, F.L.S. ; Entomologist, N.S. Wales at the W.I. Agric. Conference, Barbados, 1908.*

* * *

"So serious are dead or diseased coconut trees considered to the important coconut industry of Ceylon, that owners are compelled to cut them down. The following are among the regulations in force in Ceylon :—

(1) It shall be the duty of the owner or person in charge of every coconut tree which is dead to forthwith uproot such tree and either to consume it with fire or keep it completely submerged in water.........

(2) It shall be the duty of the owner or person in charge of every living coconut tree which is attacked by the beetle.........either completely to destroy the tree........ or to cut out and destroy the portion of the tree that is attacked.......

(3) The Government Agent, Assistant Government Agent, and every Police Officer and Headman shall have access at all reasonable times into and upon any land whereon any coconut tree is growing for the purpose of inspecting such tree........

["A proposal was made here (Jamaica) owing to the danger of bud-rot spreading, to make the burning of dead trees compulsory, and the matter was discussed by the Board of Management of the Agricultural Society, but no recommendation on the subject was made to the Government. It is a matter worth coconut

growers keeping before them, however."—ED.]—*The Journal of the Jamaica Agric. Soc., Vol. XII, No. 10, Oct., 1908.*

* * *

"In many parts of Europe it is customary among the people to burn sugar in sick rooms, a practice which is considered by physicians as an innocent superstition, neither beneficial nor harmful. Prof. Trilbert, of the Pasteur Institute of Paris, has, however, demonstrated recently that burning sugar develops formic acetylene-hydrogen, one of the most powerful antiseptic gases known. Five grams of sugar (77·16 grains) were burned under a glass-bell holding 10 quarts. After the vapour had cooled, bacilli of typhus, tuberculosis, cholera, smallpox, etc., were placed in the bell in open glass tubes, and within half an hour all the microbes were dead. If sugar is burnt in a closed vessel containing putrified meat or the contents of rotten eggs, the offensive odour disappears at once. The popular faith in the disinfecting qualities of burnt sugar appears, therefore as well founded."—*Louisiana Planter, Vol. XII. No. 16, Oct. 17, 1908.*

* * *

"Several experiment stations in the United States have been investigating the question of the pollination of tomatoes. As far back as 1890-1891 it was found at the Cornell Station that the amount of pollen used had an important influence on the form and size of the fruit. More recently these results have been confirmed at the Michigan Station......The conclusions deduced from these experiments are that when pollen falls on one side of the stigma only, a one-sided tomato always results, and the larger the quantity the greater the irregularity. The amount of pollen applied determines to a great extent the size and smoothness of the tomato, but after applying a certain amount no further increase can be obtained. The small, irregular tomatoes grown under glass are caused largely by insufficient pollination.......All the experiments........show that the setting of a good crop of smooth, heavy fruit depends largely on the care taken in distributing the pollen."—*Journal of the Board of Agriculture (England). Vol. 15, No. 7, Oct. 1908.*

Rubber Scraps.

From The Ceara Rubber Tree in Hawaii; Hawaii Agric. Exper. Station. Bulletin 16.

"It has been quite definitely determined that a system of single or double vertical cuts from 3 to 6 inches apart, without any oblique laterals except at the base, for the purpose of concentration of all the latex at one point, gives the heaviest yield of rubber and the least waste. A vertical cut is much more easily made than either the spiral, half herring-bone, or full herring-bone oblique cuts. Another point in favour of the vertical cut is that the wound thus formed heals with the greatest rapidity."

* * *

"The outward appearance of the tree is no indication of its value as a rubber producer."

* * *

"The best time to tap seems to be between 12 o'clock mid-night and 7 o'clock in the morning."

* * *

"The Cerea rubber trees differs from both the Castilloa and Hevea in the rapidity of the coagulation of the latex. For this reason it has been found that the system of vertical cuts is the best."

* * *

"......rubber can best be produced from the Ceara tree by the use of considerable quantities of water in all of the processes connected with the collection and coagulation of the latex."

* * *

"The tensile strength of the rubber is very much improved by thorough rubbing."

* * *

"The most uniform coagulant was acetic acid."

* * *

"The flow from all rubber trees is poor on bright days, on the sunny side of the tree, and during the period of early leafage after the resting stage."

"By January 1908, 400,000 rubber trees had been planted in Hawaii, upwards of 90 per cent. being *Manihot Glaziovii* (Ceara). The remainder are *Castilloa elastica* and *Hevea brasiliensis*........ The Ceara variety......grows in Hawaii better than in its native habitat. The rapidity and vigour of growth on our plantations is remarkable. Many trees show a growth of from 10 to 15 feet or more during a single season, with girth measurements in propor-

tion......trees of the Ceara variety, which have attained a trunk diameter of 6 to 8 inches at 3 feet from the ground, will yield from 5 to 10 or more pounds of crude rubber each per annum."

[*From Report of the Forest Administration of Southern Nigeria for 1906. (Colonial Reports—Miscellaneous.)*]

"The rubber-yielding plants found here are *Funtumia elastica*, very numerous, and the vine *Landolphia owaniensis*. These two species give the best quality rubber. Other species, yielding an inferior product, are the vines *Landolphia Thompsonii*, *Landolphia senegalensis*, *Carpodinus hirsuta*, and *Carpodinus fulvus*; these are fairly numerous in this forest."

"Estimates (for the Western Province) based on very low figures .....give the present stock of rubber plants at just over half a million, several thousands of which will very shortly be ready for tapping. The planting is done under forests that have been thinned so as to afford ample space and light for the young plants. The method has proved very successful, is far cheaper than clear fellings, and approximates more to the natural conditions under which the species grows."

"Experience seems to point to the conclusion that *Funtumia elastica* shows much less recuperative powers towards tapping than the Brazilian plant (*Hevea*) does......On the whole the simple "half herring-bone" method or the simple "V" one applied very lightly appear to be the most suitable for this plant."

"It has been abundantly proved of late that the rubbers yielded by *Funtumia elastica*, *Landolphia owarensis* and *Clitandra elastica* if properly prepared are off the very best quality and capable of realizing prices in the home market but little inferior to that of the best Para....Perhaps the best of all the West African rubbers is that prepared from the latex of *Landolphia owarensis*."

"In Southern Nigeria coagulation by means of heat is most generally employed...Samples of rubber prepared from the spontaneously coagulated latex by members of this Department were valued in Europe at 4/8 per lb., when fine Para was selling at 5/2 a lb."—*From "Bulletin, Trinidad."*

"Books have been written on Rubber and critiques on those books have appeared, for the most part favourable to investors, because to make an onslaught on a book would mean to make an onslaught on the progress of rubber planting and the progress and stability of the numerous rubber companies which are being promoted in all corners of the world......" In literature

issued by company promoters we often see ludicrous statements ......the explanation being that the writer was merely a literary hack employed to dish up to order any subject which may be put before him."

From the Bulletin of the Imperial Institute, vol. vi., No. 3, 1908.

"A sample of the rubber of *Forsteronia floribunda* prepared in Jamaica has been recently examined at the Imperial Institute. The plant is stated to grow profusely in the limestone districts. The analysis shows that the rubber is of good quality, the dry material containing nearly 89% of true rubber... ...It would probably realize 2/4 per lb. in London with fine hard Para from South America quoted at 3s. 5½d. per lb.

"For destroying the oxydase which is present in rubber and causes the darkening in colour. The process consists simply in coagulating the latex by means of steam, or by heating the freshly coagulated rubber in water at a temperature of 180° F, for 10 or 15 minutes. By this treatment the oxydase is destroyed and a pale coloured rubber is obtained, which it is claimed will not darken on exposure. This process certainly deserves trial by planters, since uniformity in colour is very desirable in consignments of rubber."

From the West Indian Bulletin, vol. ix., No. 3, 1908.

"Professor Harrison (British Guiana) said that they had given up the importation of rubber seed from Ceylon, and they now got them direct from Singapore. Within the last few months he had imported 62,000 seeds, and had got nearly 82 per cent. germinating. These seeds cost on arrival about 1·2c. each. They were packed in dry charcoal in seed-boxes and were sent by parcel post to ensure the quickest delivery. The plants when ready for delivery had cost altogether 2·58 cents each."

(*Note.*—The last consignment of Hevea seeds from Singapore has already given a proportion of very nearly 86% germinating, in a total of about 50,000 seeds.—ED.)

Board of Agriculture.

His Excellency the Governor presided over a well-attended meeting of the Board of Agriculture held in the Court of Policy Hall on Wednesday, December 9. Among those present were Professor J. B. Harrison (Director of Science and Agriculture), Mr. F. Fowler (Commissioner of Lands and Mines), Mr. J. F. Waby (acting Government Botanist), and Mr. R. Ward (Agricultural Superintendent). The business before the Board was of an interesting nature and important.

A report on the woods of the colony by Mr. L. S. Hohenkerk, an officer of the Department of Land and Mines, was submitted, and was pronounced by the Director to be of considerable value in view of the publication later of a more authoritative account. He thought Mr. Hohenkerk should be thanked by the Board for the great trouble he had gone to in making the report.

The annual report was then laid on the table, and the thanks of the meeting were then recorded to Mr. A. W. Bartlett, late Government Botanist, for the pains he had taken in connection with the establishment and editing of the Journal.

The subject of Rubber was next approached, and the report by the Forestry Officer (Mr. C. W. Anderson) on the experimental tapping of *Sapium Jenmani* growing wild at Bonasika creek, on the lower Essequibo river, was discussed.

Professor Harrison said that a letter had been received from the Government Secretary saying that a certain area at Bonasika would be kept for an experimental spot for tapping and obtaining rubber. The Government Secretary gave him authority to place a certain amount of money on the estimates to enable him to carry out that project.

His Excellency remarked that the report (a summary of which will be found on another page of this issue) was a very interesting one. He thought the work the Board would carry out on this plantation would be very useful. They would also get a nursery of Sapium trees there.

A suggestion by Mr. Wood Davis that extracts from the report should be printed and circulated among those interested was not adopted.

His Excellency added that the work in connection with the rubber plantation at Christianburg was proceeding. A large area was being planted with Sapium, and the site seemed very suitable.

The Director said that the place was very representative of the soils of that part of the Demerara river.

THE BONASIKA RESERVE.

In reply to a question from Mr. Gaskin, His Excellency said that twenty acres at Bonasika would be set aside for Sapium cultivation, and arrangements have been made to include in the estimates next year the cost of looking after that area. It would be possible to visit the place from headquarters, so only a watchman would be necessary.

In answer to a suggestion from Mr. B. Howell Jones, Professor Harrison said the giving of instruction in tapping rubber would receive attention. As soon as they tapped trees in the country districts, Mr. Anderson and some of the Agricultural Instructors —who by that time would have learned at Bonasika how to do it —might give demonstrations.

The progress report on the experimental fields at the Botanic Garden, Onderneeming Farm, and Issoorooro, already published, were laid on the table.

Referring to the estimates for 1909-10, His Excellency said that the establishment of an agricultural station on the Pomeroon river was contemplated, and for this a sum of £2,400 had been put down. A house there would cost $1,200, and an allowance of £100 to £150 had been made for the instructor. The upkeep of Bonasika would be provided for at $480, and cultivation and other expenses at Christianburg would be continued next year at the same cost as this.

SHOWS.

Considerable discussion took place on the subject of agricultural shows; Professor Harrison pointing out that the suggested big show in Georgetown would cost $4,800, and the proposed Agricultural Conference $1,500. His Excellency demurred at the expense while the rubber experiments were going on. It would be well not to hold the Show until 1910. The expenditure on agriculture was increasing. And if they spent $4,800 in Georgetown, they should not spend any money on district shows, for which $1,340 was on the estimates.

Mr. Wood Davis moved that that item be deleted.

Mr. Gaskin seconded.

Mr. W. M. Payne expressed the view that the village shows were a waste of money.

Mr. Wood Davis pointed out that if they were going to have the big show, the sooner they advertized it the better, so that the people could get ready for it.

Mr. Howell Jones said that a sum of $1,340 has been put down for local shows ; he thought they might finance the county shows later on. If they decided to have the big show and no county show, they could have a small vote of $500 this year simply to cover the small district shows.

His Excellency : Then we shall carry it at $500 and save $840.

The item was then passed at $500.

TOBACCO.

In commenting on Mr. Gaskin's remarks on tobacco growing in the colony, Mr. Howell Jones said that the difficulty in growing tobacco here was the enormous number of insects that attacked the crop. The question of getting an expert was one of price. They would not obtain one for less than £800 to £1,000 a year, and it would be very possible that a so-called expert from Cuba would know nothing about it. The work was kept in the hands of one or two men who received high pay from the capitalists who employed them.

His Excellency indicated that the growing of tobacco in the colony would be of considerable fiscal anxiety to the Government, as one-eighth of the total revenue of the colony was derived from the imported tobacco. There were a large number of things to be considered. He suggested the appointment of a committee.

The following were selected to serve on the committee :—Professor Harrison, the Hon. B. Howell Jones, Mr. Junor, Mr. Monkhouse, and Mr. Stockdale (on his arrival).

The Director alluded to the scheme for instituting a system of theoretical and scientific instruction to overseers and others which had been circulated, but said that as it stood it was not quite suitable to this colony. A scheme on similar lines, carefully drafted to suit the conditions of this colony, would be of considerable value.

The difficulty of getting returns of rice areas under cultivation was remarked on, and His Excellency discountenanced compulsion in the matter. The present returns gave a fair idea of the progress that was being made.

B 208.

Professor Harrison said there had been a good deal of discussion about the 208 B cane, and he had taken the trouble to have a series of water-colour drawings made from the actual cane showing the plant's variations. He had never before seen such extraordinary variations in cane produced by cultivation. It was very desirable that similar colour-records should be made of other products, for they would then gradually accumulate a very valuable record of the work done by the Department. The paintings were done by Miss Van Nooten, and he did not desire better. He thought it would be worth their while to encourage her to make a permanent record of products of that sort.

Mr. Howell Jones supported the suggestion very heartily, and hoped that they would be able to go a step further in regard to the Journal they published. He hoped the time would come when they would issue from the Board a booklet with pictures showing the different growths of the colony.

The report from the Georgetown Market stall showed that since April 3,784 plants had been sold, bringing in $115 64, while the New Amsterdam stall had sold 947 plants since September for $31 50. Altogether the two stalls sold 4,700 plants in addition to those usually sold from the gardens ; and the Director remarked that they could say that the two stalls had been a success and had been appreciated. (Hear, hear.)

A report on locally made rum puncheons promised by Mr. Dnncan was not yet to hand, but was expected shortly.

The Director submitted a report (summarized elsewhere in this issue) circulated in connection with the coconut palm disease in the colony, giving an indication of the possible cause of the disease ; and also the official accounts of the agricultural shows at Victoria-Belfield and the West Bank, Demerara—both of which, he said, had been very successful.

It was resolved to postpone an application of the Victoria-Belfield Agricultural Society for a grant-in-aid of a Farmers' Competition in 1909, and the Secretary was instructed to ascertain the constitution of the newly formed Agricultural Association on the West Coast, Demerara, which was asking for a grant for an exhibition next year.

COLONY RUM.

Professor Harrison informed the Board that a reply had been prepared to the criticisms of the colony rum, and this would be

forwarded to the Secretary of State to be laid before the Commission. It would be circulated among the members, but should be regarded as confidential as yet. He added that the money collected for the Jenman Memorial had been invested in a clock, and this was in course of erection at the Botanic Garden.

On the suggestion of His Excellency, it was agreed that the unveiling should be performed by the Hon. B. Howell Jones.

A Bill to improve the breeding of cattle was submitted and agreed to, and it was resolved to send it to the Government as from the Board of Agriculture.

The report from the experimental rice fields showed that about 13,500 gallons of grain were available for distribution as the result of the last crop. One or two imported varieties had proved better than the creole rice. It had been decided to distribute the rice this year to the leading millers and ask them to give it to those who they know would take advantage of it. The abuses which prevailed last year would thus be avoided.

The Director submitted printed copies of the papers read by him at the West Indian Agricultural Conference. With regard to colony rubber, recent reports from the Rubber Commission showed that some specimens were worth 4s. 3d. a pound, when best Ceylon was selling at 4s. 6d. per lb.

The acting Government Botanist intimated that he had about 40,000 *Hevea braziliensis* seedlings ready for distribution. The seeds had come from Singapore by parcels post.

The meeting then adjourned *sine die.*

The Model Gardens.

Record of Attendances.

Below is given a table setting out the numbers of the pupils attending the Model Gardens of the colony, arranged in quarterly periods, from April 1, 1907:—

	Bourda.	Charlestown.	Belfield, East Coast.	Stanleytown. N. Amsterdam,	LaGrange, W. Bank, Dem.	Total Attendances.
1907.						
April 1 to June 30 ...	305	337	412	329	12	1,395
July 1 to Sept. 30 ...	381	298	202	285	256	1,422
Oct. 1 to Dec. 31 ...	575	293	380	221	288	1,757
1908.						
Jan. 1 to Mar. 31 ...	597	731	389	299	187	2,203
April 1 to June 30 ...	1,438	860	183	274	243	2,998
July 1 to Sept. 30 ...	1,698	976	440	199	212	3,525

Additions to the Library.

Recent Additions to the Library of the Board of Agriculture.

Cyclopædia of American Agriculture, Bayley.
Agriculture for Southern Schools, J. Duggan.
Southern Agriculture, Earle.
Elements of Agriculture, Focam.
Rocks, Rock Weathering and Soils, Merill.
Introduction to Metallography, G. Gossens.
Heredity, G. A Thompson.
Permanent and Temporary Pastures, W. S. Sutton
Suggestions for School Gardens, G. R. Williams.

Dec., 4, 1908.

Selected Contents of Periodicals.

"Pine-apple Planting."
—*The Porto Rico Horticultural News*, Vol. i., No. 3, September.

"South African Bee-keeping."
—*The Agricultural Journal, Cape of Good Hope*, Vol. xxxiii., No. 2, Nos. 2, 3, 4, Aug., Sep., Oct., 1908.

"Bee Pirates."
—*Ibid.*, August, 1908.

"The Present Condition of Rubber Culture."
—*Tropical Agriculturist*, Vol. xxxii., No. 2, Aug., 1908.

"Wire-worms in Sheep."
"A New Hybrid Orange."
"The 'Gootee' Method of Propagation."
"Attar of Roses."
—*Queensland Agricultural Journal*, Vol. xxi., Part 2, August, 1908.

"On Varieties of Cane with special Reference to Nomenclature,"
—*Hawaii Planters' Monthly*, Vol. xxvii., No. 8, August, 1908.

"The Red Cotton Bug," (*Dysdercus cingulatus*, Fabr.)
—*Memoirs of the Department of Agriculture in India*, Vol. ii., No. 8, August, 1908.

"Disease caused by *Strongylus* Parasite."
—*Proceedings of the Agricultural Society of Trinidad and Tobago*, Vol. viii., Part 9, September, 1908.

"Tuberculosis in Animals and its Relation to Public Health."
"The 'Tsamma' or Kalahari Melon."
—*Agricultural Journal, Cape of Good Hope*, Sep., 1908.

"Agricultural Credit Societies"
"How to obtain an Allotment or Small Holding."
"Report on Small Holdings."
—*Journal of the Board of Agriculture, (England)*, Vol. xv., No. 6, September, 1908.

"Agriculture in Argentina."
"Small Holdings in Lancashire."
"Co-operation for Small Holders."
—*Ibid.*, No. 8, November, 1908.

"Some Diseases of Rubber Plants."
—*Agricultural Bulletin, Straits and Federated Malay States*, Vol. vii., No. 10, 1908.

"Ramie Fibre."
—*Agricultural Bulletin, Straits and Federated Malay States*, Vol. vii., No. 10, 1908.

"Seeding Canes."
—*Journal, Jamaica Agricultural Soc. Vol. xii, No. 10, October, 1908.*

"International Rubber Exhibition in London."
—*Bulletin of the Imperial Institute*; *Vol. vi., No. 3, 1908.*

THE JOURNAL
OF THE
BOARD OF AGRICULTURE
OF
BRITISH GUIANA.

VOL. II. APRIL, 1909. No. 4.

Answers to Correspondents.

With the object of increasing the popularity of the Journal, and, we trust, of getting into closer touch with local agricultural interests and especially the "small man" for whose benefit this magazine was founded, we purpose to make an "Answers to Correspondents" page a feature of future numbers. Already the price of the Journal has been reduced to a popular figure; a "bitt" a year must surely be within the financial capacity of the most struggling; and we desire to see that the opportunities afforded by the increased circulation at the reduced price are used to the utmost. The Director has given his willing consent to the proposal; and we have the pleasure to inform our readers that the services of the staff of the Department will be at their disposal to answer any pertinent and *bonâ fide* enquiries they may care to address to the Editor of this Journal,

c/o THE DIRECTOR OF SCIENCE AND AGRICULTURE,
The Government Laboratory,
Charlestown.

As these anticipated queries will, it is hoped, be of a practical nature, it is especially requested that specimens* may be sent with the letters whenever possible. Insect pests, plant diseases, raiding animals (including, of course, birds) are common enough, unfortunately, in this colony, and much yet remains to be learned as to the best methods of combatting their baleful activity. Questions of soil, drainage and manure must arise even in the most outlying and inaccessible districts; and the staff of the Department of Science and Agriculture, already small, cannot be ubiquitous. The Agricultural Instructors, a busy folk, are handicapped by the fact that there are only twenty-four hours

* For directions as to the best methods of packing and preserving the specimens see Note at the end of this Number.

in even the fullest working day, and it seems an improvident policy to ask that the higher officers, whose time is (in the most literal sense of the expression) money—colony money—should spend a large portion of it in profitless travelling. The cases in which this course is absolutely necessary are already sufficiently numerous. In short, as Mahomet cannot, in most instances, go to the mountain, the mountain should endeavour to come at Mahomet: and we hope, by our "Answers to Correspondents" scheme to open up a means of communication between the two. Every one who is interested in agriculture, every cane or rice farmer, every provision grower, every private person who makes a hobby of flowers or vegetables, every schoolmaster who takes an interest in his school garden, must sooner or later—usually sooner—be faced by a problem on which he would like advice. We put this Journal at his or her disposal. We shall welcome all queries, especially if accompanied by specimens. Where these last come from schools, the fullness, accuracy and reliability of the accompanying notes on their discovery, occurrence and ascertained life-history, will afford an interesting and valuable indication of the extent to which real Nature Study is spreading among the teachers of the colony. It may be argued that correspondents will have to wait some time for an answer. We would reply that the law of demand and supply controls even agricultural journals, and that a quarterly issue does not exhaust all the possibilities of publication. The remedy is in the hands of our readers.

Rice and Its Risks.

Enthusiasm is an excellent thing—even a very excellent thing —but it should be tempered with judgment. No one will deny the present importance to the colony of the rice industry or fail to give due credit to the enterprise, energy and independence of its pioneers. Within a short space of years they have developed the resources of the colony in an unexpected direction and to a phenomenal extent. They have left a permanent mark on its history and enlarged its prospects; and that without any aid but that afforded by a series of congenial seasons and favourable markets. Unfortunately the "but" is a big one; and those who do not wish to live in a fool's paradise must face the facts that seasons may change and markets fluctuate. In that case, what will become of the rice industry?

The risks which the growing of rice in British Guiana involves are patent, and have already been dwelt upon at commendable length and with praiseworthy persistence by the daily Press of the colony. It is on record that the industry on the Corentyne Coast was virtually extinguished by drought in 1899. It is admitted that the question of irrigation is vital and pressing. The effects that must follow a considerable fall in the market price have been less emphasized, but are none the less important. India is a factor in the problem which must never be lost sight of, although various circumstances of late years—years concurrent with the rise of rice in British Guiana—have combined to eliminate the influence of the great Eastern Dependency. With India once again famine-free and able to export the cereal in normal quantity, what, we repeat, would become of our rice industry?

The question, if disconcerting, is appropriate enough in view of an undeniable waning of interest in provision growing. This unfortunate tendency is unmistakably indicated. The reports of the Department of Science and Agriculture leave little doubt on the matter. Before us lie the results of the Farmers' Competition on the East Coast, held under the auspices of the Buxton Farming Association, and the comments thereon of the Director and the members of the Exhibition and Subsidiary Products Committee. From these it is evident that the enthusiasm in agricultural matters aroused among the farmers during recent years has either diminished or been transferred to the cultivation of rice—with all its risks. In other words the local "small man" is taking the perilous course of putting all his eggs into one basket, and that a receptacle which it is admitted may give way

at any moment. It is true that a great American humourist has altered the ancient proverb to read: "Put all your eggs in one basket—*and watch the basket*," but however suitable that emendation may be to business or Yankee finance, it would be fatal if applied to farming. There is much that the skilful and scientific agriculturists can influence—soil, drainage, supply—but the fundamental conditions under which he works—climate and seasons, sunshine and rainfall—are beyond his control. Even the incidence of disease and the appearance of insect pests cannot be anticipated in most cases, and he is indeed a foolish man who exposes himself to the danger of having the whole of his means of subsistence destroyed at one fell swoop. By cultivating a variety of crops the wise man insures himself against disaster. Conditions that may be adverse to one crop are often eminently suitable to another. Diseases that attack one plant pass another by. Pests are frequently nice in their appetite. There seems no reason why the fashion of rice-growing should imply the neglect or abandonment of other and safer cultivations. Rather the opposite. Common sense and experience both argue the other way, and we would not be behindhand with our warning. We are mindful of the fact that agriculture is a business; that farmers naturally look for their profit where they can most easily find it; and that provision growing is subject to certain disadvantages, of which prædial larceny is not the least. Yet for this last, at any rate, the remedy is largely in the hands of the villagers themselves. If public opinion in the country districts was seriously and unmistakably against the provision thief, the hands of the Government would be immensely strengthened. The law can provide "catting" for the culprit when caught and convicted; an energetic public spirit, by organizing vigilant societies or what not, would see to it that he was caught. The paralyzing effect of prædial larceny on industry and thrift justifies the strongest measures, but its occurrence cannot be put forward as a valid excuse for so modifying the choice of cultivation as to expose great portions of the colony to the risk of grave disaster. We have no desire to see an Indian famine repeated here on even a small scale; yet the failure of the rice crop might mean all that if the present tendency be not stopped. And, as usual, it would be the poorer classes who would be the chief sufferers. We would do nothing to check enthusiasm; but we would seriously warn the farmers of the colony to make sure that their enthusiasm does not lead them to neglect precautions which their sober judgment must suggest.

The January Examinations.

Now that the examinations in Hygiene and Agricultural Science, which made the month of January a time of trial and anxiety to many of the teachers of the colony, are over and done with, a brief review of the results may be of interest, and, possibly, of use to candidates who intend to try their luck again.

And if we dwell here more on the faults of the papers than on their merits, it is not because the former were predominant. Quite the contrary. The work as a whole showed much promise. It is a sound saying that "the man who never makes mistakes will never make anything;" the sensible man is he who profits by the mistakes he does make and avoids similar slips in the future. Such criticisms as we now venture on are made with a sincere desire to help the teachers in their uphill task; and, wemay add, we have had the advantage of the comments of the Director of Science and Agriculture to whom selections from all the papers were submitted.

The Jannary examinations were divided into two classes; those for the Teachers' Certificate, and those for students who had attended the course of lectures in the two subjects above mentioned given during the year by the Science Lecturer (Mr. E. W. F. English, M.A.). For the purpose of this brief review, the divisions will be ignored and only the subjects treated separately, as the remarks to be made apply with cogency to the candidates as a whole. There was a difference in the papers: those for the Certificate examination being of a general nature, while those for the Lectures were framed entirely on the published schedule followed by Mr. English; but the results showed a distinct similarity. Broadly speaking, the papers sent in in Hygiene were superior to those in Agricultural Science. The knowledge displayed was more accurate and the questions were better understood and more confidently answered. This does not mean that no good work was done in Agriculture. On the contrary, the best of the papers in that subject in the Certificate exam ination were excellent and earned the approval of the Director. But the average was lower, and the gap between the best and the worst was immense. In the Lectures examination nothing above a second class was obtained by any candidate in this subject, and the results in that instance were distinctly disappointing. The reverse was the case in Hygiene. The Georgetown centre did well in the Lectures test, the best of the papers being satisfactory, but not reaching the "Honours standard. Here, as in Agricultural Science there

was sad confusion between bacteria and fungi, germs and parasites. This was pardonable enough, as the more technical branches of a new subject cannot be grasped all at once. With a greater familiarity will come a clearer appreciation of these somewhat recondite points. Thus the "germ" of anchylostomiasis —often an egg—though water-borne in many cases, cannot be considered equivalent to the "germ" of typhoid—which is a bacillus. Nor can the *causa causans* of filariasis—which is a worm—be compared with the microscopic, unicellular animal which brings about an attack of malarial fever. The satisfactory feature of the examination was that it showed that the fundamental points—the dangers of mosquitoes, the importance of ventilation, the significance of proper food, and the necessity for a pure water supply—had been thoroughly grasped by the majority of the candidates. We may, perhaps, be allowed to remark here that it is out of place now for students sitting for such an examination to question the transmission of diseases by insects. The facts are accepted; and teachers wishing to come out well in the lists would be wise to study the cards issued from time to time by the Surgeon General, and assimilate the statements contained therein. An examiner is guided by them rather than by newspaper reports or letters containing the amateur views of ill-informed faddists. One curious point may be noted. In discussing the general question of cleanliness, not a single candidate mentioned the necessity for washing the hands before each meal. It was a strange and unexpected omission.

The explanation of the poor work done in Agriculture as compared with Hygiene may be found, to our thinking, in the obvious difference between the methods of studying the subjects. The principles and laws of health may easily be learned from books. Experiment is not always feasible or, from its nature, possible to the elementary student. Agriculture is essentially practical in its nature. Even the rudiments cannot properly be understood without practical work, and the structure and habits of plants can be grasped only by a careful study of actual specimens. Where a school garden is not available, pot or window-box culture may be substituted with profit. We fear that little use was made of either of these by the great majority of those who sat for the January examinations. Moreover, Nature Study should make everyone observant; and to an ordinarily observant person some of the questions asked should have presented little difficulty. Yet these very questions were invariably the worst answered. The principles which underlie the laying out of a school garden are generally those which, broadly speaking, would apply to the preparing of a "five acre plot of unempoldered savannah land" for a crop of maize. Quite a number of candidates must have seen a

school garden laid out and made up ; yet the proportion who answered that particular question even fairly well, was very small. Some left the drainage of the plot to the last. Again, take the question which referred to the germination of a seed. As a rule it is impossible to go down any street in Georgetown without noticing a mango seed just sprouting. The fruit is so common and so popular, and the method of disposing of the seed after the fruit is eaten is so primitive, that a germinating mango is possibly the most characteristic sight of the city. The same may be the case in the country, though of that we are not able to speak so confidently. The seed, too, is so large and the germination so easy to follow, that it makes an ideal specimen for study. Yet most candidates chose the bean, perhaps because it is given in the books ; and, in answering, it was painfully evident that, in many cases, the candidates had not made the experiments they described but depended upon their memory of the text for their details. In analyzing a flower, too, a common mistake was to quote the description of a typical dicotyledonous blossom and apply it indiscriminately ; in some cases to a lily —which was fatal. An examiner who has set a question to ascertain what practical work the candidate has done is not easily deceived. The internal evidence soon shows whether the student is describing an actual experience or is merely quoting the book. In one instance, however, the examinees had our sincere sympathy. Many were misled by a pernicious Americanism (which calls all grubs, maggots, or caterpillars, " worms ") into including earthworms among " insects " which were of assistance to the farmer. Their Nature Knowledge should have told them that earthworms are not insects, though tortoises are, according to the country-station booking-clerk who expounded the law of classification according to the railway company, thus :—" Cats is dogs, and monkeys is dogs, and parrots is dogs ; but tortuses is h'insecks." We know better in British Guiana where the " h'insecks " come from.

Last, but not least, we would advocate common sense in everything connected with answering set papers. After all, an examiner is a man, not a machine, and he has some, at least, of the finer feelings that redeem our common humanity. He does not delight in " ploughing " candidates. Good answers please him, if only they make the papers easier to correct. But he is very human ; and if candidates kept that fact in mind, it is probable that badly written, carelessly set out, and slovenly papers would be less frequently sent in than they are.

Agricultural Banks and Government Aid.

Memories are proverbially short in British Guiana, but some, at least, of our readers may remember that a matter of five or six years ago Mr. Luke M. Hill read a paper before the Royal Agricultural and Commercial Society of this colony, which created no small impression. It dealt with the subject of "Rural Agricultural Banks for British Guiana," and was not only published by the Society and widely sold but was later reprinted by Sir Daniel Morris in the Handbook of the Imperial Department of which he was chief. At the meeting at which the paper was discussed some of the Village Councillors attended by invitation and took part in the proceedings, and the subject was subsequently referred to at a conference of Village Chairmen with the result that a small co-operative bank was started at Victoria, E C., on similar, but somewhat modified, lines to those suggested by Mr. Hill. Agricultural Banks have been prominently before the public of late, and are of sufficient importance to remain so. The question of Government aid in establishing and maintaining them is, perhaps, a new development which may repay a brief consideration.

It is of course axiomatic (as stated by Mr. Hill) that the success of any Rural or Village Banks established here must depend on the honesty, integrity and uprightness of the people who undertake the management of them, and that the basis of success is dependent on the mutual trust and confidence in the honesty of purpose and trustworthiness of the members in *each other.* The two great principles which underlie these small banks are mutual co-operation and mutual liability. The Raiffeisen banks, indeed, to which Mr. Hill specially referred and which we, too, have particularly in our mind at the present moment, insist on unlimited liability as an essential. This necessarily confines the range of usefulness of each bank to a small district, for a personal and intimate knowledge of each member by his fellows is obviously highly desirable as a precaution. Yet that has its advantages, for in the circumstances which obtain, loans (strictly confined to reproductive purposes) are granted on the personal security of the borrower and two other members. And that these banks have done, and are doing, a vast work for the people and the nation which has had the good sense to establish them in their midst, is shown by the fact, (among many others) that in Austria the Raiffeisen establishments, introduced in 1886, had in 1904 outstanding loans to the amount of £10,772,000;* an average per society of £2,200 and per member of about £20.

* Journal of Board of Agriculture (England). Feb., 1909.

It is not our object to recapitulate the details of the organization, or to discuss the moral and economic value, of the Raiffeisen banks; we desire merely to draw attention to the extent to which they have obtained Government aid. To do this, we will quote the case of Austria, and found our remarks on data given in the excellent Journal already referred to in the foot-note. We would again repeat the statement in our last issue, that we do not believe in the hasty adoption by British Guiana of foreign institutions or laws without due concern for the peculiar circumstances of the colony. Rather should we wish to see in practice here the Japanese principle of cautious adaptation and wise modification, which seizes on all that is most suitable abroad and digests it for local use.

This prefaced, it cannot be denied that in Austria the Central Government has done a great deal to stimulate the establishment of these banks by advice, information and small loans. In Lower Austria the Central Agricultural Bank has been endowed by the Provincial Government with a sum of £8,300, and in addition the Diet determined to devote a special fund of £11,007 to the promotion of Raiffiesien Banks and similar institutions. A small grant of £12 10s. is also made to Raiffeisen banks to defray the expenses of their formation, subject to their complying with regulations as to inspection and audit. It is hardly surprising to read that the fact that the accounts are officially audited has greatly strengthened the confidence of the agricultural population in these establishments. As regards Upper Austria, the Provincial Government has since 1888, when Raiffeisen banks were first introduced into the Archduchy, granted cheap advances at 3 % interest to provide them with working capital. In addition a small loan of £8 is given free of interest towards foundation expenses. An annual grant of £200 has also been given to the Central Co-operative Bank at Linz. Courses of instruction for book-keepers and accountants connected with the societies are given, and grants made for travelling expenses and payment of teachers. The Diet also undertakes the supervision and auditing required by law, so that no expenses arise.

We see, then, that a case can easily be made out for Government aid and encouragement, both direct and indirect, towards the formation of Agricultural Credit Banks, particularly of the Raiffeisen type. There is precedent for it; though how far the circumstances justify the application of that precedent to this colony is a question we must leave to our local politicians.

Notes.

The Danger of Old Stumps.

Considerable areas of forest land in the colony are being taken up and cleared for the cultivation of such crops as rubber, cacao, and limes. It is thought desirable to warn cultivators that the logs and the stumps of trees that have been felled may constitute a danger to the cultivation, and that certain precautions should be taken.

It has repeatedly been noticed that plants which are planted in very close proximity to a fallen log or an old stump may sooner or later die. This has been held to be due to "poisonous juices" from the rotting of the log or stump, and on account of this a large number of planters will rarely put in a young plant near to either a log or a stump.

As the stumps or logs commence to rot, it has been observed that fungi are invariably present, and instead of the "poisonous juices" causing the death of the seedlings, it is the fungi spreading from these rotting logs to the roots of the plants that destroy them. On several occasions fungal threads have been traced directly from a rotting stump to the roots of young lime plants, and it is concluded that the fungus, on account of increased growth in so suitable a medium as a rotting log may have become sufficiently vigorous to kill out those growing plants that are in the immediate neighbourhood.

A large number of plants in the West India Islands have been lost in this manner, and in the Report of the Government Mycologist for the Federated Malay States for 1907, it is stated that the greater number of inquiries from planters in respect to diseases of rubber referred to the root disease, caused by a fungus that had spread from some of the numerous old jungle stumps among the rubber trees to the healthy young plants of from fifteen and thirty months old. It is further reported that fungal threads have, on different occasions, been traced from an old stump in the nursery to young plants immediately around it.

The removal of stumps from large areas of newly opened land is of course impracticable, and, therefore, planters must be prepared for some cases of these root diseases. In planting out, however it is preferable that young plants should be set out of the "line," rather than they be planted too close to either stumps or logs. Further, any plants that subsequently show signs of root disease should at once be isolated by digging trenches around them at

least 18 inches deep, and those that die should always be removed and burned, or otherwise they will become sources of infection.

On no account, however, should stumps be allowed to remain in any land that is to be used for the purpose of a nursery. They should always be carefully removed, for when planting is being done the young plants that might become affected would, in most probability, be distributed throughout the whole plantation. Those diseased plants would not alone die out, but would form centres of infection, and therefore be a danger to the entire cultivation.

In cacao cultivations in the West India Islands, it has been noticed that root disease frequently commences from bread-fruit, bread-nut, or avocado pear trees that have been planted in the cacao, and it is, therefore, advised that in new plantations these trees should not be planted, and that when any such trees have to be removed from old plantations care should be taken to extract their roots.—F. A. S.

Improved Tropical Fruit.

The interesting article by Mr. J. F. Waby in our last issue on the various methods in which the fruits of the colony may be utilized to make preserves, jams and so on, naturally raises the question of how these fruits may be improved. "The better the fruit, the better the jam," may be taken as an axiom, and the wonders that can be accomplished by thought, care and cultivation are known to those in touch with horticultural methods in England and America. The fruits of temperate climes have been more thar improved; they have been transformed; but the cultivation of tropical trees on scientific lines has, up to the present, been very much to seek. It has, indeed, hardly been attempted except in a few isolated cases. Malaya, has moved in the matter, and the Government of Perak has adopted a scheme which promises to do much for the instruction of the small holder and the improvement of his fruit trees. It is designed to establish small nurseries at different places in the State with a central station at Taipeng where native fruits could be improved by a careful system of grafting, crossing and selection. The plants obtained by these means could be distributed to the several branch nurseries where they could be grown on and sold to the native cultivators at cheap rates. It was hoped that the branch establishments would become self-supporting and prove valuable agents in the distribution of improved strains of native fruits. It was also proposed to train native instructors at the central establishment, who in turn could instruct their

compatriots in up-to-date cultural methods. Further, seeds and plants of fruit from other tropical countries were to be obtained and distributed.* Until such a scheme matures and instruction is available, it is scarcely reasonable to expect that the native cultivator will abandon his present haphazard methods and adopt more modern ideas ; but in the meantime much can be done by estate owners and others who are in the habit of growing fruit for their own use or for sale. Their efforts would certainly demonstrate to the natives in their immediate neighbourhood the advisability of adopting the same methods. The increased price of the produce from these estates should form the strongest argument in favour of their adopting the same process.

Sour Grass and Lawns.

Everyone in Georgetown who tries to keep a tennis or croquet-lawn in decent order knows the nuisance of sour grass. The weed springs up and creeps in persistently, killing or supplanting the carefully encouraged Bahama grass and making the lawn look like a patchwork quilt of varying hues of green. The rainy season is its grand opportunity. When the ground is sodden the Bahama refuses to grow, while the invader flourishes like the scriptural bay tree. Its liking for water is well seen in every city street and along every drainage trench. Where the damp lies long, where a pool forms, where the trench-level keeps the soil constantly damp, there will be found the sour grass, pushing and sturdy, and driving the feathery Bahama to the dry tops of the dams or the well-drained edges of the burnt earth roads. This observation at once gives a hint to the lawn lover. Keep the plot well drained, and the weed will be handicapped in its struggle with its weaker but more desirable rival. But that is, in most cases, a counsel of perfection. It is difficult in the flat coast lands to keep a large area thoroughly drained. How, then, to kill out the sour grass ? The result of an experiment undertaken by the Georgetown Cricket Club may, perhaps, help others to solve the problem.

In April last year the committee of the Club determined to try and extend their match pitch which was badly invaded by the sour grass. It was stated—though not absolutely proved—that a few years ago the entire field at Bourda consisted of Bahama, and that the weed had taken possession almost unobserved. However that may be, steps were at once taken to get rid of some of the pest. Dr. Rowland, whose interest in and knowledge of such things is well known, was consulted, and

* Agric. Bull., Str. and Fed. Malay States, Oct. 1908.

on his advice East Indian women were engaged to dig up each root of sour grass with the point of a cutlass. One portion of the piece selected for experiment was treated thus, while another area was "scroped"—*i. e.*, the whole surface turf was removed by a sharp edged native spade—and the results were carefully compared. As might have been expected, the former plan, though slower and more expensive than the latter, proved by far the better. As the Bahama roots spread, it was occasionally necessary to have the ground "run over" by boys to remove chance germs of sour grass that had been overlooked; and it was found essential to fill up the holes left by the cutlasses so that the runners of the Bahama might spread evenly. Unless this was done, the grass tended to grow in stools and made the ground lumpy. Lastly a top dressing of finely powdered earth (clay) was put on by hand and rolled in after the rain had thoroughly softened it. In this way a perfectly level surface, well bound by the Bahama but not felted or spongy, was obtained. When the scroping was adopted, the ground lay bare for a long time, and the danger of stools forming was much increased. As a result of these trials, which have been repeated lately on a fresh piece of turf, the G.C.C. have doubled the area available for match wickets. Others who try the method suggested may prove equally fortunate.

The Mango Difficulty.

The mango is a luscious fruit and juicy, but is not to be lightly attempted as a dessert fruit in polite society. In fact the expert mango-eater becomes such only after many trials and much patient practice. "The Porto Rico Horticultural News" gives a pathetic account of the experience in this matter of a young stranger in Mexico. After dinner, mangoes were brought in; and remarking that the fruit resembled a "pear which has been sat on," the visitor proceeded to confirm the statement that though of "mild appearance" the mango was "most deceitful." It may be explained that "pit" seems to be American for "fruit stone" or the local "bone."

"About me the others were eating their mangoes in dignified ease, the fruit poised gracefully on forks while they nibbled about the suburbs of the pit. I prepared to do likewise. I closed my teeth firmly on the yellow meat. It had a pleasant, turpentiny flavour, but when I tried to disengage my bite from the surrounding pulp I found that the fruit was held together by hundreds of fibres. In my mad efforts to break these threads with my teeth my face became glazed with a thin coating of mango. My second bite was a repetition of the first, and this time both ears were filled with the pulp, and one eye was entirely closed. I wondered it one could absorb his mango through the pores of the skin, but I attacked the fruit for the third time. On this occasion there was a general breaking loose

> of the pulp from the seed. The juice dropped from my chin in rivulets and sparkled on my shirt bosom like many topazes. I threw away my fork and took the mango resolutely in both hands. I was oblivious of everything but the determination to conquer that mango. The sticky juice ran up my sleeves as I gnawed at the pit as a dog gnaws at a bone. I finished the mango amid a profound silence. Then as I looked up all adrip and shining with mango juice, my Mexican friends began talking in a polite but feverish way. But the American kicked me under the table and said in a stage whisper 'Now excuse yourself and take a bath.'"

The story ends with this receipt for eating mangoes:—"Put on a mackintosh, a pair of rubber boots and goggles. Then get a clamp to hold the mango to the table while you gnaw." While allowing our American friends all credit for their much advertized inventiveness and enterprise, we cannot admit that this method is superior to that advocated in British Guiana and hallowed by tradition—"Take off your clothes and eat it in a bath." That, as Martin Harvey would say, is the Only Way. And it saves so much trouble. The American in the story quoted had to take a bath in the end.

The Treatment of Weeds in Permanent Crops.

What is the most economic treatment of weeds in plantations of such crops as cacao, coffee, oranges, limes, or rubber? This is a question that has often been raised by cultivators, and is one that has received attention at the hands of experimenters.

In the tropics, vegetative growth is exceedingly rapid, and consequently the expenses of weeding crops that take some years to reach the full-bearing stage are often enormous, and not infrequently they represent a very large proportion of the total expenses of the plantation. Is it possible that this expense can be reduced, without sacrificing in any way the health and vigour of the permanent crops or without damaging the condition of the soil? This question is particularly of importance to the cultivator who is commencing with small capital, who therefore desires to raise a plantation of healthy trees as economically as possible. Nor is it without interest to the capitalist, especially when low prices render it necessary to reduce expenditure. Further, it is a matter that should receive the attention of the peasant proprietor.

In planting a large number of permanent crops, it is the common practice to interplant with such temporary crops as bananas, plantains, cassava, etc., in order that some returns may be obtained during the first few years of growth. This practice may be considered a satisfactory one from a weeding point of view, for the shade afforded by the temporary crops considerably reduces the number of weeds, and therefore reduces expenses. Sooner or later, however, it is necessary for the growth of the permanent trees that the greater portion of the provision crops should be removed. Weeds now become more numerous and require more constant attention, and again the question arises as to what is the most economical method of dealing with weeds in order that the best results may be obtained from the permanent crops.

METHODS.

The different methods that may be adopted may here be grouped under separate sub-heads. It is possible to practise the following methods :—

(a) *Clean weeding*, either by means of constant use of the fork and hoe or by means of the hoe alone.

(b) *Clean weeding and cutlassing*—by clean weeding a circle around each tree, and allowing the weeds in the intervals to grow, to be cutlassed down at definite intervals.

(c) *Cutlassing*—by allowing the weeds to grow and to cut them down periodically with a cutlass, and either to use the weeds as a mulch around the trees or to allow them to remain where cut.

(d) *Green mulching*—by growing "smother crops" to kill out the weeds, to be cutlassed down periodically and allowed to rot on the ground.

The advantages and disadvantages of the different systems may now be briefly discussed:—

(a) *Clean weeding.*—This is carried out by forking the land between the trees at definite intervals and by weeding with a hoe. Sometimes the forking is dispensed with. The hoe alone is then used, and the weeds are either buried or allowed to rot in heaps. This system is adopted on many cacao plantations in the West Indies, where a thorough forking is given once in every two or three years, and the weeds that grow during the intervening years are cut up with the hoe and buried in small pits dug throughout the fields, while the fields are lightened by "cracking" the earth with the fork without turning the soil. On other cacao estates the forking is dispensed with and hoeing is practised, the weeds being buried in small pits, while on some lime estates where hoeing alone is practised the weeds are allowed to rot in heaps or are collected around the roots of the trees.

Thorough forking of the soil renders it more pliable and more easy of drainage, and prevents the drying of the lower soil by capillary action. It also lets in light and air into the soil and generally improves the tilth. Against this it may be pointed out that as the land is denuded of any covering, a large amount of

SURFACE EVAPORATION

of moisture and of heat radiation takes place, while the "baking" effect of the tropical sun may have some injurious effect upon the normal bacterial action in the soil, whereby the dormant plant food is made available. Heavy rains, moreover, wash most of the finer soil particles and humus of the surface soil deeper down, and a large quantity of this valuable soil may eventually find its way into the drains, especially if the land is not quite flat. If the permanent trees have grown to a fair size, the forking may produce heavy root pruning, that may set them back for some time. Further, forking is a particularly costly process, as also is hoeing and the burial of weeds. The use of the hoe alone is not generally to be recommended, for it has usually been found that only the top soil is scraped, that a hard surface is left beneath this, and that the weeds are rarely satisfactorily dealt with.

(b) *Clean weeding and Cutlassing.*—This method consists of keeping a circle clean around the trees, with forkings at definite periods, and allowing the weeds to grow in the intervening spaces. This method is a compromise between clean weeding and cutlassing solely. The forking around the trees must cause some injury to the roots, but this may be offset by the fact that the roots of the trees are kept free from the injurious effects of weeds and if the grass that is cutlassed down is applied as a mulch on these cleaned circles, loss of moisture by evaporation is prevented and the general tilth of the soil is improved. This mulch should not be placed immediately around the trunk of the tree, for such a practice has been shown to be injurious, but it should be spread evenly in a circle commencing at least 18 inches or 2 feet from the trunk, and as the trees grow this circle should be enlarged. On the other hand, care must be taken that a hollow is not left around the tree, in which water may accumulate.

(c) *Cutlassing.*—On many estates, where the rainfall is heavy and the growth of weeds luxuriant, the weeds and grass are allowed to grow, and they are cutlassed down at periodical intervals, and either used as mulch around the trees or allowed to rot on the ground where cut down. This system is adopted in many young cacao plantations, and in a very large number of the Dominica lime cultivations. By this surface covering of weeds, the soil is prevented from being "washed," and it is protected from the harmful effects of the sun. The conditions are also favourable to the bacterial action for the liberation of plant food, for the moisture content and temperature of the surface soil are favourable to bacterial growth. Against this, it is urged that the soil will suffer in tilth from lack of proper tillage, and that the soil will be improperly aerated. The cutting down of the weeds, however, causes some of them to die, and the drainage and aeration that results from the death of the roots is a matter that must receive consideration. The weeds and grass use up some of the plant food that should be available for the trees, but it is

NOT PERMANENTLY REMOVED

from the soil, as the grass and weeds are cut and left on the soil to increase the humus in the soil. Again, they evaporate directly from their leaves a large quantity of soil water, and thereby cause a loss of moisture directly from the soil. It has, therefore, practically to be decided whether the benefit derived from the surface covering, sufficiently offsets the loss of moisture and plant food through the weeds and grass; particularly when the reduction of the weeding expenses over the clean weeding method is borne in mind.

On many of the lime and cacao estates in Dominica this form of culture has been practised for a considerable time, and the results have during the last ten years been closely investigated by Dr. Watts, now Imperial Commissioner of Agriculture, and it has been found that the physical condition of the soil generally remains good. The permanent crops grow well under this system, and "wash" of the soil is prevented, even on the steepest slopes. The application of the cut grass and weeds as a mulch around the roots of the trees is probably better than allowing them to rot where cut down, as it affords direct protection and good addition where the feeding roots of the permanent trees are situated. This system is practised in the coffee cultivation at Onderneeming School farm, under the direction of the Department of Science and Agriculture, and on some sections is assisted by bringing in additional material for mulching purposes. It has been quite satisfactory, and increased crop returns have been obtained. The weeds or mulch must not, however, be packed too close to the trunks, or otherwise they keep the trunks too damp and favour the growth of fungus diseases and the presence of insect pests.

It is well here to add a

WORD OF WARNING

in regard to this system. Para grass should on no account be allowed to grow in permanent cultivations. It should always be dug out and burnt, or otherwise it is likely to become a troublesome pest. It was once observed on a cacao plantation in St. Lucia that the removal of Para grass was not properly done from the beginning, with the result that larger expenditure was incurred in doing it at a later date, when its injurious effects were being felt by the cacao trees. The difficulty of getting rid of this pest when once established is well known in this colony, and care should therefore be taken with it.

(d) *Green mulch.*—This system consists of growing cover crops, preferably of leguminous plants, to smother out the weeds. These crops are cut down just as they commence to flower, and allowed to remain on the soil as a mulch. The advantages of this system over the cutlassing of weeds is that control is kept of the growth between the permanent crops, that the leguminons crops benefit the soil by their root nodules, and that a larger amount of material is available for mulching purposes. Less cutting down is needed, and the expenses thereby reduced, but against this reduction must be placed the cost of the seed and the cost of establishing the cover crops. For cover crops purposes a number of leguminous and non-leguminous plants have been experimented with. Cow peas, Bengal beans, and *Canavalia*

ensiformis have been found suitable in the West Indies, while *Crotalaria striata*, *Mimosa pudica* and *Desmodium triflorum* have given good results in Ceylon and the East.

In the foregoing, the chief merits and disadvantages of the different systems have been briefly discussed, and it now remains to ascertain what is to be advised for the conditions pertaining in this colony.

EXPERIMENTS.

Experiments by the Department of Science and Agriculture to ascertain what plants are the most suitable for the cover crops in this colony will be made, and the different systems will be given a trial at the various experiment stations distributed throughout the colony. Those plants which are found to be suitable, will, during the first year, be saved for seed, in order that quantities may be available for distribution to the planters and others that are desirous of carrying out experiments in their cultivations. Seed of *Crotalaria striata*, from Ceylon and also locally grown, is to be sent for trial at the Rubber Station at Isorooro, in the North-West, while other local plants are to be under careful investigation at the various experimental fields. Among these, will be tried *Crotalaria retusa*, *Canavalia ensiformis*, *Canavalia obtusifolia*, *Canavalia gladiator*, *Phaseolus semierctus*, Bengal beans, Iron cow peas, and Wooly Pyrol, while experiments will also be carried out with others that give promise to be suitable for the purpose of green mulching.

One of the most interesting points in connexion with the green mulch system has recently been raised by Mr. J. B. Carruthers, in his Annual Report for 1907, as Director of Agriculture in the Federated Malay States (shortly to take up duties in the newly organized Agricultural Department in Trinidad). By sowing seeds of such a plant as *Crotalaria striata* as soon as the land is felled and burned for rubber planting, and before the rubber plants are put in, the growth of weeds and under scrub is greatly prevented and expenses, therefore, considerably reduced. From this report the following extract has been taken, and may prove of interest:—"By far the best time to establish one of these plants at a minimum cost is directly the land has been burnt off. Having once got the plant established, the immediate necessity of putting the rubber in is over, since the fields do not get any worse, but rather better, for the reception of the rubber plants and the cost of cutting away the crotalaria, mimosa, or other plant to put in lines and holes is very little. The only weeding necessary is in case jungle trees or

scrub sprout and these can easily be noticed among the prevalent growth of a single plant and removed. No soil is lost from the beginning of the opening of the land, and the gain in this to the roots of the rubber plant is not to be neglected."

F. A. STOCKDALE.

Strength of Local Woods.

Some valuable information concerning the strength and durability of the timber occurring in Surinam is contained in a pamphlet* compiled by Herr E. K. Plasschaert, a forest officer in Dutch Guiana; and as the details of the experiments and the results arrived at may be of interest to all users of wood in this colony, a brief summary is here given. Many of the Surinam trees occur in British Guiana, as would be expected when the similarity of the conditions in the two adjoining countries is considered. An attempt has been made, therefore, to identify, as far as possible, the species mentioned in Herr Plasschaert's text and to give them the local names they bear in British Guiana. This was the more important as the author notes the confusion of names which prevails in the wood markets of Surinam: different timbers being sold under the same name, and the same tree having more than one local cognomen. To Herr Plasschaert is due the credit of making a systematic investigation and of collecting materials for the Government Herbarium. The botanical identification of the species was made by Dr. A. Pulle of Utrecht. The actual experiments on the strength, breaking strain, and modulus of elasticity of the woods were made by Engineer J. F. Ligtenberg, sometime of the Forest Department of Dutch Guiana, and were carried out at the instance of the Colonial Railway of Paramaribo. These were supplemented by details obtained by Herr H. A. van der Speck† and by trials conducted by the "Banc d'épreuves de l'état" at Mechlin. The primary object was to obtain some reliable figures as to the strength and elasticity of the timber used on the railway, and care was taken to get samples from as many places as possible and to compare Herr Plasschaert's specimens with those bought in the wood markets of Paramaribo. Only well-seasoned wood, which had lain some months in the depôt at Beckhuizen, was used in the tests, but no special investigation as to its dryness or otherwise was undertaken.

Method and Apparatus.

The tests were carried out on laths of rectangular section 5 x 5 c.m. (2 x 2 inches) supported at two points 100 c.m. (39·37 inches) apart and weighted in the middle. The weighing apparatus consisted of a hook, a cylindrical vessel with chains to hang it on

* "Breekproven aangande een-en-twintig der meest gebruikelijke Surinaamsche houtsoorten, vermeerderd met aanteekeningen omtrent botanische benaming, voorkomen, gebruik, enz," door E. Plasschaert. (Inspectie van der Landbouw in West-Indie. Bulletin No. 11, 1907.)

† "Beschrijving van de timmerhoutsoorten die in Europeesch Guyana wassen," door H. A. van der Speck.

the hook, loose weights of 50 kilograms each (50 kilo=110·25 lb. avoirdupois) which were slung in pairs over the centre of the laths tested, and water to fill the vessel—which was provided with a tap and a graduated gauge to measure the amount of water in it at any given time. By these means a total weight could be applied of:—

Vessel, hook, and chains	...	140 kg. =	308·7 lb.
Water to top of gauge	...	660 „ =	1,455·3 „
Loose weights 6 x 2 x 50 kg.	...	600 „ =	1,323·0 „
		1,400 kg.	3,087 lb.

With the exception of certain of the greenheart samples, all the pieces of wood tested broke before this weight was reached.

The laths to be tested were first weighed and accurately measured. Every precaution was taken to ensure precision on the actual manipulation of the experiments. The amount of bending under the weights applied was measured by a slide-rule from a line coincident with that joining the points of support of the lath, and could be read to half-millimeters. It was taken at the middle point of the lath. Preliminary experiments to determine the approximate breaking strains were made.

Calculation.

The calculations were founded on the formula :—

$$M = \tfrac{1}{4}\, W\, L$$

$$E = \tfrac{1}{48}\, \frac{L^3 W}{d\, I}$$

Where

f = the modulus of rupture in ... ... K.G./c.m.^{2}
E = the modulus of elasticity in ... ... K.G./c.m.^{2}
W = the load in ... ... K.G.
L = the length between the points of support in c.m.
d = the amount of bending in the middle in c.m.
M = the bending moment at the centre in ... c.m.^{3}
I = the moment of inertia of the section in ... c.m.^{4}

There were further included :—

b = the breadth of the section in ... ... c.m.
h = the height of the section in ... ... c.m.

With M replaced by $\frac{1}{6}$ f b h^2 and I by $\frac{1}{12}$ b h^3, the formula became :—

$$f = \tfrac{3}{2}\, \frac{W L}{b h^2}$$

$$E = \tfrac{1}{4}\, \frac{W L^3}{d\, b\, h^3}$$

from which formula the co-efficients were calculated. For the laths which satisfied the standard measurements (5 x 5 c.m.), the terms $\frac{3}{2}\frac{L}{bh^2}$ and $\frac{1}{4}\frac{L^3}{bh^3}$ were constant, (amounting to $\frac{6}{5}$ and 400 respectively) which simplified the calculations very much.

"ELASTIC LIMIT."

The amount of bending measured was, without exception, at first proportional to the weights used; but as the breaking-point was approached it became sensibly—often seriously—greater. Whence it followed that the modulus of elasticity did not possess an equal value for all weights but was smaller for greater values of these. There was therefore an "elastic limit," which may be defined as the tension below which the modulus of elasticity is constant. The calculated modulus of elasticity always refers to the bending measured below the "limit." The method can best be shown by an example :—

Test 24.—Greenheart.

Piece 120 c.m. long (47·24 inches), b = 5 c.m., h = 5 c.m. (2″ x 2″)
Weight 3,307 grams (7·27 lb.)

Weight Applied.		Bending.	
323 kg.	(712·2 lb.)	0·65 c.m.	(·256 inches.)
423 „	(932·7 „)	0·9 „	(·355 „)
523 „	(1,153·2 „)	1·05 „	(·414 „)
623 „	(1,373·7 „)	1·3 „	(·512 „)
723 „	(1,594·2 „)	1·45 „	(·571 „)
823 „	(1,814·7 „)	1·65 „	(·640 „)
928 „	(2,046·24 „)	2·0 „	(·788 „)
998 „	(2,100·59 „)	2·3 „	(·906 „)
1,068 „	(2,354·94 „)	2·6 „	(1·024 „)
1,138 „	(2,509·29 „)	2·9 „	(1·143 „)

Lath broke just at this point.

Specific gravity $= \frac{3300}{120 \times 5 \times 5} = 1·10.$

At breaking point W = 1,138 kg.

$f \times b = \frac{3}{2} \times \frac{1138 \times 100}{5 \times 5}$, $f = \frac{6}{5} \times 1,138 = 1,365$ K.G./c.m.^{2}

Bending (1·65 c m.) approximately proportional to weight up to 823 kg.

$\therefore\ E = \frac{1}{4} \times \frac{823 \times 100^3}{1·65 \times 5 \times 5^3} = 400 \times \frac{823}{1·65} = 200·000$ approximately K.G./c.m.^{2}

The minimum number of trials with each kind of wood was five, but this number was considerably exceeded with the more

valuable species of timber. With the apparatus used it was not possible to ascertain the breaking point of certain of the samples of greenheart; and it would be interesting to have the experiments pushed to their limit with this very important wood.

A summary only of the results can be given here. Readers interested may be referred to the original monograph for fuller details. The results are given in round figures, for there is no object in mathematical accuracy :—

KIND OF WOOD.		Specific Gravity.	Modulus of Rupture, K.G./c.m.²	"Elastic Limit," K.G./c.m.²	Modulus of Elasticity, K.G./c.m.²
Manbarklak	...	1·05	1,200	900	180·000
Bruinhart	...	0·95	1,350	1,000	200·000
Wallaba	...	1·10	1,050	900	170·000
Purperhart	...	0·90	1,300	1,000	180·000
Groenhart	...	1·10	1,500	1,100	230·000
Bolletrie	...	1·10	1,400	900	200·000
Wana ...	...	0·70	750	500	140·000
Spijkerhout	...	1·15	1,400	1,000	260·000
Pisie (white)	...	0·50	600	350	130·000
Plokonie	...	0·85	700	600	150·000
Locus ...	...	1·05	800	700	160·000
Peto or Mora	...	1·15	950	700	180·000
Copie ...	...	0·85	1,050	750	150·000
Baboenhout	...	0·55	450	300	90·000
Krappa ...	...	0·65	650	450	120·000
Riemhout	...	0·80	1,000	800	190·000
Ajoewa ...	...	0·55	500	350	80·000
Ceder ...	...	0·45	375	250	80·000
Djedoe ...	...	0·80	150	600	100·000
Ingipipa	...	0·75	800	500	170·000

For comparison are given the results of similar tests with precisely comparable pieces of other woods :—

Oak	... ...	0·85	600	215	100·000
Fir	... ...	0·55	470	200	108·000
Deal	... ..	0·45	420	230	111·000

The colony names for these woods have been supplied, where possible, by the Government Botanist (Mr. F. A. Stockdale) from specimens in the Georgetown Herbarium, with assistance

from notes made by the Forestry Officer (Mr. C. W. Anderson) as under :—

Surinam Name.	*Botanical Name.*	*British Guiana Name.*
Manbarklak	*Lecythis longipes*	*Lecythis chartacea* and *L. subglandulosa*=Kakeralli. ,, *corrugata*=White Kakeralli. ,, *grandiflora* = Wadaduri or Monkey Pot.
Bruinhart	*Andira inermis*	Bat seed. (Leeward Islands=Bastard Mahogany; Trinidad=Angelin.)
Wallaba or Bijlhout	*Eperua falcata*	Red-flowered or Soft Wallaba.
	Eperua rubiginosa	Wallaba.
Purperhart (red variety)	*Peltogyne paniculata*	*Peltogyne pubescens* = Coroballi, Purpleheart, or Wallababalli. Purpleheart = *Copaifera pubiflora*.
Groenhart	*Lecoma araliacea*	
Bolletrie	*Mimusops balata*	Burué, Kobéru, Balata, Bullet Tree.
Spijkerhout		
Pisie	*Nectandra Pisi*	*Nectandra leucantha*=Suraballi, brown siruaballi, or silverballi. ,, *Rodioei*=Greenheart, bibira, sipiri. ,, *vaga* = Honohousorie. ,, spp. = Yellow sirruabelli, belaro serraballi.
Plokonie, Variety i.	*Pithecolobium pedicellare.*	
,, ,, ii.	*Inga alba*	
Locus	*Hymenaea Courbaril*	Locust or Simiri.
Peto or Mora	*Dimorphandra Mora* var. *excelsa*	Mora.
Copie	*Goupia glabra*	Cabucalli, Cabacarri, Kabukalli.
Baboenhout	*Myristica surinamensis*	Dalli, Dalliba.
Krappa	*Carapa procera* and *C. surinamensis*	*Carapa guianensis*=Caraba, Carapa, Crabwood.
Ajoewa	*Parkia discolor*	*Parkia pendula*=Hipaneri, Hippanai, Ipaneye.
Ceder	*Cedrela oderata*	Koiarli, Akoayari. (West Indian Islands = Red Cedar.)
Djedoe	*Sclerolobium paniculatum.*	

From this list it will be seen that investigation into the local woods both here and in Surinam is desirable. As to the value of the timber, Herr Ligtenberg has much encouragement to offer. He considers that the tests prove that among the woods of Surinam (and this applies to our local species) are many with far greater co-efficients for strength and elasticity than European timber exhibits. The recognized durability, too, of colony woods

should give rise to a wide range of application for various purposes; and he thinks it not unlikely that many works for which European lumber is now employed might profitably be constructed of Surinam timber.

These experiments constitute but the first step towards the knowledge of the characteristics of local material; their amplification is desirable; and the determination of other co-efficients—such as those for stresses and strains—should bring to light many other valuable features which lie dormant in the native trees.

Insects and Veterinary Diseases.

The important part that insects take in the transmission of many veterinary diseases ought to be of considerable interest to the inhabitants of British Guiana, for the place might be described as an "insect paradise."

I cannot possibly deal with more than one insect in this article, and I select as my subject a tick, the *Boophilus bovis*, the carrier of Texas or red water fever, as the disease is to be found in all parts of the colony.

In a report to the Government in 1908 I dealt fully with the subject, and I will, therefore, on this occasion, only allude to the salient points in connection with the tick and fever, also the symptoms, treatment and prevention.

Over 90 per cent. of cattle imported into British Guiana from northern climates die in a short time after their arrival from Texas or red water fever, despite the care and attention usually bestowed upon them. This terrible bovine scourge is caused by a protozoon, a pear-shaped micro-organism, which enters the blood stream and destroys the red blood corpuscles. It is conveyed from animal to animal by the Texas tick, the *Boophilus bovis.*

The male tick is usually about 0.15 of an inch in length and 0·09 of an inch in breadth. It has an oblong body and is of a reddish colour. The body is constricted in the middle, and at the lower half there are two longitudinal furrows. The females have an olive brown back, and slate coloured belly.

There are two forms of the disease, the acute and chronic. In the acute form, which appears only to attack cattle imported from the north, the symptoms are: high temperature, loss of appetite, diarrhœa or constipation, blood-coloured urine, and, the blood, on microscopical examination, is found to contain a pear-shaped parasite in the red blood corpuscles—the protozoon *Pyosoma bigeminum.* These protozoa are generally in pairs.

Native cattle suffer from the chronic form, which is recognized by emaciation, unthrifty coat, anæmia, and an usual number of ticks about the body, generally on the dewlap and flanks. The red blood corpuscles contain the same organisms, but in a different phase of life, and appear as small black points.

The treatment of acute Texas fever is most unsatisfactory and seldom results favourably. A full dose of purgative medi-

cine should be administered, followed by fever draughts and plenty of good nourishment—gruel and whiskey, bran, tea, etc. The animal must be kept in a comfortable loose box free from draughts, but with plenty of fresh air. The after-treatment consists of mineral tonics, *i.e.*, sulphate of iron, etc.

Chronic Texas fever seldom terminates fatally, and, as a rule, by keeping the animal free of ticks and giving tonics a cure will result. A very good application for the ticks is equal parts of kerosine oil, sulphur and linseed oil.

To eradicate the tick in a country like this, where the pastures are all unfenced and animals mix, would be impossible, but if systematic ticking was done, and the ticks burned, they would be kept down considerably, with the result that the animals would be in much better condition.

Farmers who are desirous of improving the breed of animals by the importation of better stock should either get their animals from the Southern States, where they as youngsters suffer from chronic Texas fever and enjoy a permanent immunity afterwards, or have the animals from the North immuned at one of the stations of the Board of Agriculture of America.

J. A. RALEIGH,
Govt. Veterinary Surgeon

The Jenman Memorial.

When the late Mr. G. S. Jenman died in 1902 it was evident that the services which he had rendered to the colony would deserve some memorial. He had been Government Botanist for more than twenty years. As Superintendent, he had made the Botanic Gardens the pride of Georgetown. He had, in conjunction with Professor Harrison, done much to bring the products and resources of British Guiana before that wide public out of the colony which knows so little of the more remote treasures of the Empire. He had displayed a foresight and an enterprise which were not always appreciated at their full value at the moment, but which were proved by time. Such a man could not be left without a monument. A committee was appointed. Subscriptions were solicited. A sum of money was collected ; and after considerable delay and discussion a clock was decided upon as the form the memorial should take. The order was sent to the famous firm of Messrs. J. W. Benson, of London ; and on Friday, January 8 last, the time-piece was unveiled before a distinguished company.

A better choice of site could hardly have been made. From the gable end of the pretty little office at the entrance to the Botanic Gardens the big dial of the Memorial Clock looks out, its gilt figuring showing boldly against a dead black background and the legend : "To the memory of George Samuel Jenman, F. L. S.," encircling the whole. On the wall below is a brass plate bearing the inscription : "To the memory of George Samuel Jenman, Fellow of the Linnæan Society, Government Botanist and Superintendent of these Gardens, from 1879 to 1902, to whose knowledge, skill and work the colony is indebted for the laying out of the Gardens and the formation of the Herbarium." On the day of

THE UNVEILING

the company quite filled the space in front of the office, and included His Excellency the Governor, Lady Hodgson, and Mr. G. Ball Greene, Sir H. A. Bovell and Lady Bovell, His Lordship Bishop Parry, D. D., Sir Thomas Crossley Rayner, Professor J. B. Harrison (Director of Science and Agriculture) and Mrs. Harrison, Dr. Godfrey, Mr. and Mrs. R. C. Grannum, Mr. and Mrs. J. Robson, Mr. and Mrs. Park, Mr., Mrs. and Miss Howell Jones, Mr. J. F. Waby (acting Govt. Botanist) and Mrs. Waby, Mr. and Mrs. Luke M. Hill, Mr. and Mrs. Fowler, Mr. and Mrs. Hemery, Mr. and Mrs. Fred May, Mr. and Mrs. Wood

Davis and Mr. and Mrs. E. A. V. Abraham. To the Hon. B. Howell Jones fell the actual performance of the ceremony, and the delivering of the memorial speech. It was a fitting choice. Of the original Board of Directors who had the first charge of the gardens, few indeed survive: but though Mr. Howell Jones is not one he had known Mr. Jenman intimately, and he dwelt on the particulars of his life and career with affectionate persistence. He detailed the late Government Botanist's education in the nurseries round Plymouth (where he was born); his removal to Ireland; his connection with Kew Gardens in 1871, where he rose to be foreman of the Herbarium Department. He went on to his appointment as Superintendent of Kensington Gardens, Jamaica, where he laid the foundations of the great reputation as an expert in ferns which he afterwards enjoyed, and whence he proceeded to British Guiana. Mr. Jenman came to the colony in August, 1879, when preparatory work had been done by their present head gardener, Mr. Waby, who was still with them, he was glad to say. He prepared the ground for Mr. Jenman who came out here and laid out the gardens they saw before them. But that was by no means his whole work. In fact it was almost the minor part of the work which he did in the colony. Those intimately acquainted with Mr. Jenman knew he had

VAST CORRESPONDENCE

in nearly every part of the globe with various botanical societies, British and foreign, and he not only corresponded but exchanged plants and seeds; and as they saw he had a great variety of plants imported which had done well and flourished exceedingly, so much so that many visitors characterised the gardens as the best in the West Indies. They had a variety of palms which was almost unknown in any other part of the world. Those who had studied botany must be aware of the enormous work entailed in forming a herbarium. They had a herbarium which was a credit to him who started it. Any one seeking information in the colony could go and find the name and see the leaf and the flower of almost every known tree and plant in the colony. It was a wonderful collection, and it was duplicated by Mr. Jenman—the duplicate being now in Kew and highly valued. Not only did he correspond with various botanical societies throughout the world, but he studied here most carefully and wrote some very valuable works. Especially would he refer to what he had written in Timehri and elsewhere in reference to his voyages and travels throughout this country, and the interesting way in which he made various observations of what he had seen,

They could not go along the streets without recognizing what Mr. Jenman did to beautify them. They knew the beautiful avenues, the work in connection with which was carried out by him with the aid of the Town Council. Those were all works of his, which, as colonists, they should all feel exceedingly proud. He had been asked to present the clock to His Excellency with the hope that he would take charge of it, so that in future generations when persons might come to the gardens and, recognizing the beauty of them, ask who had designed them, they would be able to read the tablet and see the memorial erected to him by colonists here. There remained little more for him to say beyond that Mr. Jenman was easily accessible Anyone who desired to obtain information could easily do so. He was indeed fond of his work, and the work they saw showed that he had a master mind to guide the master hand he possessed.

Then with a sharp pull, Mr. Howell Jones drew the cord, the green baize curtain was gathered to one side, the "veil" fell from the tablet and the ceremony was complete. It remained only for the Governor to reply; and in doing so

HIS EXCELLENCY SAID

it gave him great pleasure on behalf of the colony to take charge of the clock, and more especially as it had been placed there as a memorial to a Government officer who had done such excellent work in the colony. If Mr. Jenman had done nothing more than call attention to the resources of the colony in connection with balata and rubber he would still have earned their gratitude, for both those products had created industries which were becoming annually more important. He ventured to think that the rubber tree which bore his name—*Sapium Jenmani*—was likely to be one of the most important rubber trees in the near future, and on that account likely to bring some wealth to the colony. They had heard Mr. Jones say that Mr. Jenman was a hard worker in many other ways; he thought Mr. Jenman also a hard a worker in agriculture, and it was on that account that they wished to perpetuate his memory. He had much pleasure in formally accepting on behalf of the Government the clock, which he ventured to think, would be an important adjunct to the Botanic Gardens which Mr. Jenman loved so well.

Rice in the Colony.

Official Returns for 1908.

The following is the official return of the area and yield of rice in British Guiana for the year 1908:—

County and District.	Acres.	Bags of Paddy. (120 lbs.) Total Yield.	Yield per Acre.
County of Demerara—			
East Coast District	1,767	43,062	24
Mahaica "	1,830	42,519	23
Abary "	5,603	94,846	17
West Coast "	3,382	81,383	24
West Bank "	118	3,447	29
East Bank "	482	14,460	30
River "	20	Not returned.	...
Totals, Demerara	13,202	279,717	21·2
County of Essequibo—			
River District	3,753	93,820	25
South Essequibo District	1,814	71,510	39*
North Essequibo "	2,335	130,037	57*
Pomeroon "	650	15,145	23
Totals, Essequibo	8,552	310,512	36·3
County of Berbice—			
East Coast and Canje District	6,275	153,773	25
West Coast District	4,271	113,198	27
Corentyne Coast District	4,452	76,917	17
River District	1,099	28,562	26
Totals, Berbice	16,097	372,450	23·1
British Guiana	37,851	962,679	25·4

* Two Crops.

Board of Agriculture.

Importation of Infected Canes.

An important resolution was moved by Professor Harrison at the meeting of the Board of Agriculture held on Thursday, February 11, and carried. It had reference to precautions necessary to prevent the importation into British Guiana of infected canes from abroad, and was in these terms :—

"The Board of Agriculture recommend, under Section 2 of the Importation of Plant Diseases Prevention Ordinance, 1903, to the Governor-in-Council that the importation of all sugar canes and cuttings thereof from Java, Australia, Fiji, Brazil and the West Indian Islands shall, owing to the prevalence of insect pests, fungoid and other diseases, be subject to the following conditions :—

(1) Sugar-canes or cuttings thereof from Java, Australia, Fiji, Brazil and the West Indian Islands shall not be admitted to be imported in any description of earth or soil.

(2) All sugar canes or cuttings thereof from the above-mentioned places to be inspected by the Government Botanist before being removed from the wharf or stelling at which they are landed and not to be removed from that place unless permitted by the Government Botanist in writing.

(3) If, on such inspection, the sugar-canes or cuttings be found to be not free from pests or diseases of any sort already known to occur in the colony the sugar canes or cuttings to be treated as the Government Botanist may direct before removal from the wharf. If they are found to be infected with any pest or disease not ocmmonly known in this colony the sugar canes or cuttings to be destroyed under the supervision of the Government Botanist or an officer of the Department of Science and Agriculture delegated for that purpose.

(4) If their removal is authorized by the Government Botanist, the sugar-canes or cuttings thereof to be planted in a nursery apart from the general cultivation and separate from other varieties of canes, and to be subject from time to time during twelve months from the date of importation to inspection by the Government Botanist or by an officer of the Department of Science and Agriculture deputed by the Director for that purpose. If the canes are found at any inspection to be suffering from any pests or diseases already known in the colony they shall be treated as may be directed by the Government Botanist, and if suffering from any pests or diseases not commonly known in the colony they shall be rooted out and destroyed under the immediate supervision of the inspecting officer."

In introducing the motion, the Director remarked that the Sugar Cane Committee were unanimously in favour of the proposal. The Government Botanist, who had had experience of similar restrictions in the West Indian Islands, would examine the canes at the wharf and satisfy himself that they were not affected by any disease, fungus, or insect pest. The matter was pressing, as sera was prevalent in Java, gumming in Australia and Fiji, and froghoppers in Brazil and some of the islands.

Mr. Brumell seconded, and the motion was carried.

Professor Harrison announced that the Jenman Memorial had

been completed, and the Clerk to the Board (Mr. O. Weber) reported that, after paying all expenses, a balance of $4 remained in hand.

It was decided to retain the balance until it was certain that no more accounts would come in for expenses incurred in putting up the clock.

RICE RETURNS.

Professor Harrison laid on the table rice returns (which are reprinted in another page of this number of the Journal.) He said that the returns related to last year and were as corrected by the Commissaries. The total area under rice cultivation was returned at 37,851 acres, the yield of paddy being 962,679 bags of 120 lb. each. The average yield was 25·4 bags per acre. He had made the forms more full than those that had been used in earlier years as he thought that members of the Board would be interested to see the divergence in the yield per acre for the different districts, which varied from 17 on the Abary to 30 on the East Bank of the Demerara river. Some, of course, were for two crops in the course of the year. Then the total crops were very much higher. In North Essequibo the yield was 57 bags, or 34 bags from the early crop and 23 from the later. In South Essequibo the yield was 39 bags for the two.

His Excellency said that these returns were not quite complete, as one or two owners and rice-farmers declined to give information.

Professor Harrison said that very few refused. They would be perfectly safe in saying that the area was 38,000 acres.

The January number of the Journal of the Board was submitted to the members.

STALLION FEES.

Professor Harrison said that the Stallions Committee had recommended that the fees charged for services of the Government stallions should be reduced from $10 to $7 50, for each mare, the groom's fee remaining as before at $1. There were many people in the colony having good horses or mares suitable for raising carriage horses and draught horses, and it was felt that the fee of $10 was somewhat beyond their means. It was considered desirable therefore to reduce the fee. As the stallions were imported solely for the purpose of producing draught stock, they felt justified in suggesting this reduction. They were not laying themselves out for the production of racing stock.

The recommendation made by the Stallions Committee was sent to the Government, and in their letter of February 2 they accepted it.

His Excellency the Governor (Sir F. M. Hodgson, K.C.M.G.,) presided over a well-attended meeting. Among those present was Mr. F. A. Stockdale, the Government Botanist and Assistant Director of Science and Agriculture, who took his place for the first time as an *ex officio* member. On the motion of His Excellency, Mr. Stockdale was appointed Deputy-Chairman.

Notices of Books Received.

"The Settlement of the Magistrates' Courts, Georgetown, British Guiana," by LEONARD PERCIVAL HODGE, A.M.I.C.E.

This is an interesting monograph, published in the Minutes of the Proceedings of the Institution of Civil Engineers, and contains valuable information as to the foundation, load, and the behaviour of the foundation under the load, of the familiar Magistrates' Courts of this city. It is of importance to all builders here to know the maximum weight per superficial foot which may be imposed upon structures resting on the compressible alluvial clays of the colony, and for want of it unnecessary expenditure is often undertaken. In the case treated of in this paper it was estimated that enlargement of the foundations would cost about £335; it was decided, as an alternate course, to allow the building to settle under constant supervision; and the results are well detailed by Mr. Hodge of the Public Works Department. Summed up, the total settlement was approximately 1·6 foot in thirteen years (1890–1903) when the building became stationary with the exception of slight oscillation, including—a very curious result—certain *rises* due to the expansion of the clay soil under heavy rain. The author concludes that foundations of the nature described cannot bear more than 7 cwt. per superficial foot without risk of settlement.—A. L.

"Suggestions for School Gardens: with Appendices," prepared for the Board of Agriculture, Jamaica, by J. R. WILLIAMS, M.A., Inspector of Schools.

"Our short experience with School Gardens in Jamaica," says Mr. Williams in his preface, "has shown the need for some collection of practical suggestions which shall apply, with an eye to our local conditions, the information that is available in different forms in agricultural text-books and serve to keep fresh in the minds of Teachers what they learn in the way of practical work at the Training Colleges and in special Agricultural Courses. As the novelty of the work wears off, the School Garden is apt to show increasing poverty of effort and lack of variety; and this means loss of interest and diminished educational benefit and practical usefulness. This small book has been compiled at the request of the Board of Agriculture, and its aim is to supply, in some measure, such a need." Mr. Williams is to be congratulated both on the clearness of vision in perceiving the weakness of the average agricultural text-book and on his success in supplying what it lacks. He sees that general principles need supple-

menting to adapt them to local requirements, and that what the school teacher wants is the hints which will enable him to make *practical* application of what he has learned. In this little book he supplies just these hints to the fortunate masters of Jamaica. It may be read with profit by our local teachers if they will keep in mind that Jamaica is not British Guiana, and that what suits the island conditions will not necessarily be the best thing to do on the continent of South America. The book which will do for them what Mr. Williams has done for their colleagues in Jamaica still remains to be written.—A. L.

"Lessons on Elementary Hygiene and Sanitation, with special reference to the Tropics," by N. T. PROUT, C.M.G., M.B., C.M. (Edin.) Special Edition, 1909. Price 2/-

The teaching of elementary hygiene and sanitation is now general in the elementary schools of the colony, and a special effort has been made to improve this teaching by the lectures that are given by the Science Lecturer to the Primary teachers. One of the principal difficulties that the authorities have had to contend with in furthering the teaching of this subject has been the want of a reference book dealing with elementary hygiene in conditions similar to those of this colony. The excellent work prepared by Dr. Prout, however, is now available and may be recommended. A limited number of copies have, indeed, been obtained and awarded to those teachers who did best in the Hygiene section of the recent examinations—to be used not as a text-book but as a guide.

The contents of this book are divided into fourteen lessons and deal more especially with the sanitary problems of tropical life. Originally a series of six lectures were given by Dr. Prout, late of the Medical Department, Sierra Leone, but these were subsequently extended and illustrated so as to form an elementary text-book for use in the tropics. In the first part of the book the rudiments of human anatomy and physiology are dealt with, in order that a proper understanding of the function of the different parts of the body may be obtained, and so that the effects of disease may the more readily be understood. The different causes of a large number of diseases are carefully and thoroughly set forth, while special attention is given to their treatment and prevention. The chapters dealing with animal parasites are of particular interest, and too much importance cannot be attached to those portions having reference to malaria and its treatment and prevention. The question of sanitation of the dwelling is carefully dealt with, and personal hygiene receives separate attention.

The wording throughout has been made as simple as possible, and the work is fully illustrated. It should prove a useful addition to the libraries of our elementary teachers, and should prove a valuable guide in preparing notes for their lessons. Further, it has the advantage of not dealing with the subject from a local standpoint, so the teacher has to carefully think over what is applicable to the conditions of this colony and what is not. As the development of this colony depends largely upon the health conditions that prevail on the cultivations, it is only reasonable to suppose that the proper understanding of personal hygiene and sanitation by the younger generation may prove to be an important factor in the agricultural progress of the colony. —F. A. S.

Cuttings.

Cheap Pine-apples. "The cultivation of pine-apple in Singapore Island has taken larger dimensions than before; large tracts of country formerly occupied by secondary growth being now cleared and covered with pine-apples. Great quantities of pines have been also brought into Singapore from the islands around. The result of this immense crop has been that pine-apples have been selling in town for one cent apiece, and up country for five for one cent—that is, about twenty for a penny. The tinning trade is now apparently entirely in Chinese hands. It is satisfactory to see in many of the pine-apple fields, coconuts or rubber being planted, as pine-apple culture is by no means good for the land."—*Straits and F. M. S. Agric. Bulletin.*

What to do with Mangoes. "In a short time the Queensland mango crop, which promises to be a very large one, will be ready for harvesting. What is to be done with the fruit? Locally it is impossible to dispose of the large quantities produced. It remains to consider whether they can be exported with advantage. The mango, except in an unripe state, is a fruit which does not carry well unless great care is observed in the packing......" The Fruit World" describes a so-called "Safety Export Fruit Case" for over-sea and inter-state fruit trade. The inventor of this case claims for it that it will ensure safe transit, will not damage, and cannot be pillaged. It is a basket box, 20¼ inches long, 9¼ inches wide and 6¾ inches deep. Inside this a set of cardboard pockets is placed in which the fruit is packed, each individual fruit thus having a ventilated compartment to itself. When the first or bottom layer is thus packed, a flat piece of cardboard is placed on top, making a complete division; then on this is packed another layer of fruit, and the lid nailed on. The benefit is obvious. Safe transit is absolutely assured, the fruit cannot be damaged or pillaged. Fruit thus packed always brings top prices...... these boxes are protected by patent......But the difficulty is not insuperable by any means. The inventor......is willing to supply prices to anyone making application......and considers the cost to the grower, with set of fillers complete (any size), would be only 1s. 2d. As the mango season is just opening, we cannot impress on our Queensland friends too strongly the need of getting in touch with this matter at once.—*Queensland Agric. Journal.*

Burning Forest Trees. "The use of saltpetre for getting rid of heavy forest timber has proved successful in many instances, and also in our experience. Last year we saltpetred several large useless ironbark and stringybark trees, and early in the present year these were successfully burnt. One large peppermint tree..burnt splendid until nothing was left but a few of the smaller branches. Trees of this class, not treated, took many days and heavy labour to burn off. The quantity of salt to use is only regulated by the diameter of the tree and the size of auger used. Note that when the first charge of saltpetre is seen to be absorbed, the hole must be charged a second time. (The hole must be plugged.) When the second lot is absorbed, ring the tree and wait till it dies before firing. The whole process may take a year."—*Ibid: Answers to Correspondents.*

Another Check on Mosquitoes. When cultivating one of the multicellular Alga, in glass jars in the open air, it has been found that it forms an efficient trap for several species of mosquitoes, both in the egg and in the larva stage. The Algæ during growth contains at times a sufficient amount of gas to float it on the surface of the water, and on this floating material eggs are laid. When hatched, the larvæ fail to extricate themselves from the glutinous mass, and quickly perish. Those which happen to escape at first are finally found adhering to the growth of the glutinous material at the bottom of the receptacle; nearly mature larva being caught by it, in numbers, and perish in the algal growths. This observation shows one of the many checks on the spread of these ubiquitous insects which exist in Nature, and prove that the "green slime"—as algal growth is sometimes called—has no little effect in assisting to maintain the balance of Nature—especially as regards the growth and distribution of mosquitos, and instead of being, as some suppose a disease producer, it actually forms one of the means of reducing the numbers of insects which are proved bearers of several well-known diseases the tropical agriculturist is liable to contract. It may also be mentioned that the algal or green growths seen in water may be taken as an indication that the water is potable, as they will not grow in contaminated water.—J. H. HART, F.L.S., *in Proc. Agric. Soc., Trinidad & Tobago.*

Cattle Rations at Sea. "An inquiry has recently been addressed to the Board of Agriculture (England), as to the food necessary for cattle during ocean voyages in order to land them, at as moderate an outlay as possible, in good healthy condition. It is considered that the following rations would be suitable for full-sized cattle weighing about 1,500 lb.:—14 lb. hay, 7 lb. straw,

(cut up) 5 lb. crushed oats, 3 lb. bran, 1 lb. crushed linseed. On alternate days 10 lb. of mangolds might, with advantage, be given in place of the ground linseed, when a little less hay would be required. Cattle of less weight would naturally require less food. For an animal weighing about 1,000 lb., 10 lb. hay, 5 lb. straw, 3 lb. oats, 2 lb. bran, and ⅔ lb. linseed would be suitable. The ration required by full-sized cattle would be enough for five large or six small sheep, but a daily allowance of roots instead of the linseed meal would probably give more satisfactory results. A reserve of fodder is necessary to allow for possible delays.—*Journal, Board of Agric. (England), Vol. xv, No. 11, Feb., 1909.*

A Good White-wash. "A first class white-wash is made by dissolving 2 lb. of ordinary glue in 7 pints of water, and when all is dissolved, adding 6 ounces of bichromate of potassium, dissolved, in a pint of hot water. Stir the mixture up well, and then add sufficient whiting to make it up to the usual consistency, and apply it with a brush in the ordinary manner as quickly as possible. This dries in a very short time, and by the action of light becomes converted into a perfectly insoluble waterproof substance which does not wash off even with hot water, and at the same time does not give rise to mould growths as whitewash made up with size often does. It may be coloured to any desirable shade by the use of a trace of any aniline dye or powdered colouring, while by the addition of a small proportion of calcic sulphite its antiseptic power is much increased.—*Journal of Jamaica Agric. Soc.*

Value of Acetylene Refuse. The residue left after acetylene gas has been made from calcium carbide consists theoretically of calcium hydrate, *i.e.*, slaked lime, and should therefore be suitable for application to gardens. Commercial calcium carbide is, however, apt to contain small quantities of calcium phosphide and possibly of calcium sulphide, which might affect the value of the residue for horticultural purposes, though it is probable that the risk of injury would be slight. This is borne out by the experience of two correspondents, both of whom are well qualified to judge. In one case this residue has been used for ten years, being mixed with ordinary soil, and the mixture then spread on the surface and afterwards dug in. Another correspondent considers it of the greatest value on clay soils, the only caution necessary being to allow it to weather sufficiently to destroy its caustic powers before it is put on soil where there are growing crops or where planting is to take place at once. It is also stated to be most valuable for running direct into cesspools, as it takes out most of the solid matter, leaving a practically

clear effluent, whilst the sludge at the bottom of the cesspit, when dug out at the end of the year, is an excellent manure.—*Journal, Board of Agri., England, Feb., 1909.*

Soil Inoculation. "Professor Bottomley has recently been lecturing at King's College, London, on the results obtained by the use of bacteria for supplying nitrogen to soils deficient in that element. It is not long since great expectations were formed as to the possibility of increasing the fertility of the soil by this means, and it was even stated that a man could carry the manure needed for five acres of land in his waistcoat pocket. Of late, however, like many other projects, little has been heard of the matter. Professor Bottomley wished it to be understood that soil inoculation is not a universal panacea. It simply meant adding nitrogen-fixing bacteria to the soil. Those bacteria were very delicate little things and required very careful handling. They were not to be pitched out wholesale, anywhere ; the conditions must be suitable. The remarkable results obtained in America* were in poor soil. Good soil did not respond to inoculation. The ideal soil for this purpose was soil poor in nitrogen. Soil which it did not pay to manure, or which it did not pay to farm, might be brought into cultivation so as to produce large crops if it were only looked after and provided with suitable bacteria. One of the most important facts brought out as the result of reports received was that the maturing of a crop was considerably hastened by soil inoculation, and that meant increased profits.....One grower sent up his runner beans six weeks after the seed was put in, which was a thing never done before."—*Queensland Agric. Journal ; Dec., 1908.*

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* Careful tests have been made at the S. & A. Department Experimental fields here with bacterial cultures specially prepared for the sugar cane and sent out from Professor Bottomley. The results so far have been *nil*

The Model Gardens.

RECORD OF ATTENDANCES.

Below is given a table setting out the numbers of the pupils attending the Model Gardens of the colony, arranged in quarterly periods, from April 1, 1907:—

	Bourda.	Charlestown.	Belfield, E. Co.	Stanleytown, New Amsterdam	La Grange, W. Bank, Dem	Suddie, Esseq	Total Attendances.
1907.							
April 1 to June 30...	305	337	412	329	12	...	1,395
July 1 to Sept. 30...	381	298	202	285	256	...	1,422
Oct. 1 to Dec. 31...	575	293	380	221	288	...	1,757
1908.							
Jan. 1 to Mar. 31...	597	731	389	299	187	...	2,203
April 1 to June 30...	1,438	860	183	274	243	...	2,998
July 1 to Sept. 30...	1,698	976	440	199	212	...	3,525
Oct. 1 to Dec. 31...	1,714	819	465	115*	411†	160‡	3,684
1909.							
Jan. 1 to Mar. 31...	1,638	710	338	463	370	302	3,821

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during the instruction given by the Superintendent Teacher. It has not yet been found feasible to keep a record of the many attendances during his absence.

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* School in vacation November and December.
† Vacation in December.
‡ Instruction commenced in November.

Selected Contents of Periodicals.

The German Sugar Duty.
—International Sugar Jour., Vol. xi., No. 123, March, 1909.

Notes on the Sugar Blight and the Frog Hopper Papers.
—Proc. Agric. Society of Trinidad, Vol. viii., Part 12.

Importation of Live Stock into Brazil.
Suppression of Tuberculosis in New York State.
—Jour. Brd. of Agric. (Eng.), Vol. xv., No. 10, Jan., 1909.

A South African Uniform System of Stock-branding.
Scientific Ear-marking.
External Parasites on Poultry in South Africa.
—Agric. Jour. Cape of Good Hope, Vol. xxxiv., No. 1, Jan., 1909.

Capital in Agriculture.
Theory of the Parasitic Control of Insect Pests.
Recent Researches regarding the Germination of the Coconut and the Deterioration of its Products.
—Tropical Agric. (Ceylon), Vol. xxxii., No. 7, Jan., 1909.

Collection of Para Rubber on the Amazon and its Future.
The Avocado Pear.
—Ibid., Vol. xxxii., No. 5.

Tetanus or "Lock-jaw."
—Republic of Cuba, Sec. of Agric., Circular No. 31.

Animal Pathology.
—Queensland Agric. Jour., Vol. xxi., Part 6.

Planting of Fruit Trees.
Shoeing of Horses.
—Jour. Brd. of Agric. (Eng.), Vol. xv., No. 12, Mar., 1909.

Colds in Horses.
Flies on Cattle.
—Jour. Jamaica Agric. Soc., Vol. xiii, No. 2, Feb., 1909.

Forwarding Diseased Specimens for Examination.

In a former number of the Journal (Vol. i., pp. 53-5) hints were given as to the preparation, packing and transmission of Specimens to the Government Botanist's office, but it is thought advisable to bring forward again the most essential points, for the guidance of those who have not the former article available.

(1.) A few fragments of a diseased plant are of practically no value for a scientific investigation. Sufficient material should always be sent, so that the primary cause of the trouble may be located.

(2.) Full particulars should be given as to the nature and extent of the damage done, the part of the plant attacked, the nature of the soil, drainage, the prevalence of the disease, when it was first noticed, and whether any similar kind of disease had been previously observed in the neighbourhood.

PACKING.

(3.) Specimens of portions of plants attacked by fungi may be sent green if packed in a well-ventilated box if the time taken for delivery is under 24 hours, but if delivery takes a longer time all leaves or soft fruits should be placed in a bottle or corked tube containing a solution made of 1 part of rum or methylated spirit and 2 parts of water. As many stages of the disease as possible should be sent, with notes as to the nature of each stage.

(4.) Living insects should always be packed with a supply of the plant on which they were found feeding, and the box should have some small holes pierced for purposes of ventilation. These should be carefully packed in such a way as to prevent their becoming crushed in transit.

(5.) Hard-bodied insects such as beetles, grasshoppers, bees, etc., may be killed by immersing in boiling water for about half a minute. They should be allowed to dry, be wrapped loosely in soft paper, each insect in a separate piece, and then packed in a strong box.

(6.) Butterflies and moths should be killed in a poison jar or by squeezing the body below the insertion of the wings. They must be handled carefully to prevent injury. Butterflies should have their wings folded back to back and each specimen separately folded in paper, while moths may be wrapped loosely in tissue paper.

(7.) All soft-bodied insects such as grubs, worms, plant-lice, etc., should be sent in small bottles preserved in diluted rum or other spirit.

All specimens should be accompanied with detailed particulars of the nature of the disease.

INDEX TO VOLS. I. & II.

1907-1909.

NOTE.—*Owing to incorrect numbering of the pages in Volume I., an asterisk has been added to the second series of numbers.*

A.

D.

E.

S.

T.

W.